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THE TYPES OF EUCALYPTUS PANICULATA SM. AND E. SIDEROPHLOIA BENTH. AND THEIR PROBABLE RELATIONSHIPS.

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The names *Eucalyptus paniculata* Sm. and *E. siderophloia* Benth. are applied to timber trees, known commonly as white or grey ironbark, and broad-leaved ironbark respectively. They occur along the greater part of the coastal districts of New South Wales, and well into those of Queensland, with the latter tree ascending on to the tablelands in places.

While re-arranging the Kew collection of Eucalypts according to Blakely's classification (Key to the Eucalypts, 1934) it became clear that some uncertainty concerning the intrepretation of these names exists, and it was considered advisable to investigate the types of these species. The evidence available shows that the names are being more or less misapplied, and that the situation is complicated by the presence of hybrids in both cases.

Since Smith's original description of *E. paniculata*, published in 1797 (Trans. Linn. Soc. 3 : 287), is inadequate for identification, it is not surprising that later investigators, without access to the type, should have described and illustrated plants which differ to a greater or lesser extent from it. Evidence that the situation is complicated by the existence of hybrids is discussed later.

Botanists who have had occasion to study *E. siderophloia* since Bentham have found his concept a most unsatisfactory one. Nor is this surprising, as the ten sheets of syntypes now at Kew, and the National Herbarium, Melbourne (representing six of the nine or more collections cited with the original description) appear to be part of a hybrid complex (or, more probably, complexes). Mueller (Eucalyptographia) found it necessary to " redefine " Bentham's species. Maiden (Crit. Rev. 1 : 324) has observed that the specimens which " most literally conform to Bentham's description are mixed ones of *E. paniculata* and *E. siderophloia* . . . . The description also fits more or less well to specimens from Paddy's Hill Woy Woy, Taree to Wollamba, and Port Macquarie ". These latter specimens are in his opinion exceptional, a fact which would fit well with the apparent hybrid character of Bentham's material. Maiden states

that he " follows Mueller in looking upon *E. siderophloia* as having a rather long operculum ", and the unit to which he applied the name is among the syntypes of *E. siderophloia* var. *rostrata* Benth. It is to this unit that the name *E. siderophloia* is at present being applied, though it differs sufficiently from the syntypes of that species to be considered separate.

The types of the above species and variety are here described in detail, with relevant additional notes.

The Kew material of Sieber 468 (*E. ornata* Sieb. nomen nudum), a collection which has been assigned to *E. paniculata* (and *E. pilularis* Sm.) by Bentham, and *E. siderophloia* by Maiden, has also been investigated, and the Kew syntypes of *E. fibrosa* F. Muell., which has been considered a synonym of *E. siderophloia*, examined.

Criteria for Assessment of Hybridity.

These collections show the haphazard variation in combinations of characters which exists between the different members of the one hybrid population, and also variation within the one individual of particular characters, usually regarded as constant for the species, which is characteristic of many hybrid individuals. Unusually wide variation in anther characters and some leaf characters is shown within single shoots of some of the apparently hybrid material considered here. Maiden has reported instances of wide variation in some trees of fruit characters usually regarded as constant. It has been observed by the writer in the field in Australia, particularly around Armidale, N.S.W., where many of the Eucalypts are undoubtedly hybrids, that while some Eucalypt trees had leaves which were essentially uniform in shape, in others there was a high degree of variation in leaf shape on the one tree. Wide variation in the shape of leaves on the one tree has been found characteristic of hybrids in *Ulmus* (Melville, private communication). The possibility that it may indicate hybridity in *Eucalyptus* is worth investigation.

Variation within the one shoot of the distance of the intra-marginal vein from the edge of the leaf has also been observed in the material described here. This character is often used in the field and has been described as constant for individual species by Mueller in Eucalyptographia, Maiden, Crit. Rev. *6* : 393, Baker & Smith, Research on Eucalypts, pp. 18–19.

All investigators who have used anthers for purposes of classification have recognised that in many Eucalypts they are uniform, each one being essentially the same as any of the others of the same species. In some of the shoots described here, however, two or more distinct anther forms occur within the one flower. This is particularly well marked in some of the syntypes of *E. siderophloia* Benth. (W_2 and B—see Fig. III; F_1 F_2 G—not illustrated) and one of the syntypes of *E. siderophloia* var. *rostrata* Benth. (Fig. IV, 5). In such flowers it is often hard to find two anthers which are really identical. Those of the whole group of syntypes vary in the most haphazard way. Individuals with uniform anthers presumably represent " good " species, or hybrids whose parents have similar anthers. Further investigation with known hybrids and good species is warranted. If, as appears likely, variation in the anther characters within the one flower indicates a hybrid with parents of

different anther forms, this will be very useful in assessing the status of such suspected hybrid material in the herbarium.*

Technique : Critical examination of the anthers on the dried material has been facilitated greatly by the technique used. Whole flowers (or buds where open flowers were not available) were placed in a dilute aqueous solution of a spreader (Teepol). After a few minutes the anthers were fully imbibed, and to all appearances had returned to the original shape. None of those which were drawn showed any sign of crumpling or shrivelling†, not even peculiar shapes such as those of Fig. III A_v. C_{III}. With a technique which gave a less satisfactory reconstitution these might well have been disregarded on the grounds that they had not returned to the original shape. The observation of 2 or 3 anthers (which was all that Maiden was sent from type material on occasion) is obviously quite inadequate for the assessment of anther form in material such as this.

In some stamens glands which are fully immersed in the tissues of the connective and anthers were observed e.g. *E. siderophloia*, syntypes C & E. They are probably not visible in either dry or fresh material mounted in air.

Small apparently superficial glands of the kind illustrated by Maiden (ibid Pl. 47, figs. 20b) were not observed in the Kew specimens of what is apparently the same collection (Fig. IV). (Woolls' specimens of Large-leaved ironbark came from Cabramatta near Parramatta—Maiden 1 : 326). In view of the use which has been made of anthers for the purposes of classification, detailed examination of glands in relation to the rest of the anther in both fresh and dried material of representative species is desirable.

In connection with these studies it is interesting to note the remarks (Edgar Anderson, Evolution 2 : 1–9, 1948 and Introgressive Hybridisation, John Wiley and Sons, 1949) that the natural occurrence of hybrids is apparently restricted to places where suitable habitats exist within reasonable distance of the parent species : that the habitat in which an F_1 hybrid is most likely to reach maturity is one which is intermediate in every respect between the habitats of the parents : and that the development of the many possible combinations in the F_2 depends on the existence of a wide variety of habitat combinations. He found that in the parts of the United States with which he was concerned such variety of conditions was only likely to be encountered in places which had been disturbed by man. Brett 1949 (ANZAAS Conference) commented that hybrids of Eucalyptus in Tasmania are frequently found among the regrowth following clearing i.e. where the habitat has been disturbed ; and Pryor 1950, Proc. Linn. Soc. N.S.W. *75* : 97, that a hybrid between *E. pauciflora*

*Pryor, Proc. Linn. Soc. N.S.W. *76* : 140–8, has suggested that sterility barriers may exist between the major taxonomic divisions Macrantherae, Renantherae, and Terminales, as defined by Blakely. The variation in anther form shown by some of the specimens investigated here, particularly Woolls' She Ironbark—see Fig. III W_1 W_2 W_3, is strong evidence for hybridisation between a member of the Terminales and one of the other groups. It may be that the anthers of some of the intergroup hybrids suggested by Brett, 1937 e.g. *E. ovata* × *E. pauciflora*, will show variation of anther form within the one flower.

†Though this was sometimes seen in filaments and staminodes.

and *E. dives* is fairly frequent in some parts of the tablelands where "stony ridges adjoin cold plains" i.e. where natural intermediate environments would exist.

Eucalypts are known to be sensitive to slight changes in environmental conditions. It may be no coincidence that the complexes considered here extend along the coastal areas of New South Wales and Southern Queensland, where there is a mosaic of different soils and a variety of topographic and climatic conditions. Even without the extensive disturbances caused by settlement in this area the rapid changes in topography may well provide, within a reasonable distance of the parent species, the range of ± intermediate habitat conditions which are needed for the development of a range of F_2 individuals.

E. PANICULATA *Sm. in Trans. Linn. Soc.* 3 : 287 (1797).

The type material, now in the Smith herbarium at the Linnean Society, London, was collected at Port Jackson by David Burton and obtained from Sir Joseph Banks' herbarium. It consists of one shoot with buds, flowers, and leaves. There is no fruit. The original description being very brief, a fuller one is provided below.

DESCRIPTION : *Branchlets* angled near top of shoot, otherwise rounded. *Leaves* fairly thin, alternate ; petiolate (with petioles 6–12 mm. long), very slightly dorsiventral (midrib to some extent channelled on upper surface and raised on lower surface), 5–8 cm. long, 0·9–1·8 cm. wide, narrow-lanceolate to lanceolate, nearly straight to falcate, ± acuminate ; *intramarginal vein* close to edge ; *lateral veins* fairly fine, leaving midrib at an angle of 40–55°, ± regular, at intervals of about 1·5–2 mm.

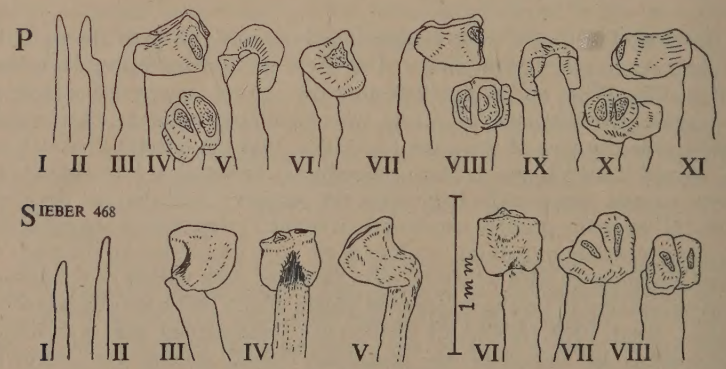

FIG. I. P. Representative staminode tips and stamens from a single flower of the type of *Eucalyptus paniculata* Sm.

Sieber 468. Representative staminode tips and stamens from a single flower of the Kew specimen of Sieber's no. 468 (*E. ornata* Sieb.) Close to *E. paniculata* Sm.

Inflorescence a short terminal panicle, the lowermost umbels in some cases in the axils of leaves ; usually 4 flowers to the umbel. *Peduncles* slightly flattened, 4–11 mm. long, up to nearly 2 mm. across, and less than 1 mm. thick. *Buds* 5·5–7 mm. long, tapering gradually into an angled pedicel 4·5–6 mm. long ; *operculum* shorter than calyx tube,

almost conical to domeshaped, usually slightly apiculate, about 2 mm. long and 3½ mm. across at base ; *calyx-tube* turbinate 4·5–5·5 mm. long, 4 mm. wide, with 4 almost rib-like angular striations which continue down the pedicel. *Filaments* bent, 5–6 mm. long ; outermost stamens sterile, *staminodes* tapering to a point, not gland tipped ; anthers rounded cuneate with ± slit-like to elliptical pores on the distal end (see Fig. I) ; *gland* present, immersed in tissues, visible through the pores. *Filaments* stout, not tapering towards the top, attachment of anthers lateral. Stamens appear fairly uniform, except for a few transitional to the staminodes.

Fruit and seed : absent.

Stamens shown in Fig. I, P, buds in Fig. II.

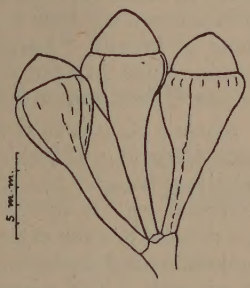

Fig. II. Buds from type of *Eucalyptus paniculata* Sm.

None of the material in the Kew Herbarium is exactly like the type. The nearest is one of the 6 shoots attached to one of the two Kew sheets of R. Brown No. 4736 from Port Jackson. Nor are any of the existing illustrations or descriptions exactly like the type. The nearest illustrations are Maiden's : Crit. Rev. Pl. 57 figs. 8a, b— again part of the R. Brown collection at Port Jackson distributed under No. 4736 ; and Pl. 197 figs. 3a, c, the type of *E. nanglei* R. T. Baker, collected either at Lindfield, near Sydney, or Nowra. Both differ from the type in having more pointed opercula, calyx-tubes which are conical rather than turbinate, less distinct and regular occurrence of angular ridges on the calyx-tubes, longer leaves, and, in the R. Brown material, in the intramarginal vein being distinctly removed from the edge. The specimen illustrated by Mueller in Eucalyptographia as *E. paniculata* shows a calyx-tube nearer to that of the type, although without the angular ridges, and the intramarginal vein well removed from the edge. The anthers are also rather different—some like those illustrated have been seen on one of the specimens collected by Woolls as " She Ironbark " and placed by Bentham under *E. paniculata.**

It has already been pointed out by Maiden, Crit. Rev. 1 : 324, that Woolls " She Ironbark " from Parramatta is " mixed *E. siderophloia* and *E. paniculata* ". The two sheets of this collection at Kew appear to form part of a hybrid complex linking the two, and presumably represent specimens from more than one tree. Bentham has labelled one sheet *E. siderophloia*, the other *E. paniculata*—the one labelled *E. siderophloia* being part of the material on which he based that species. Two of its shoots (W_2, W_3) have anthers which tend toward the other syntypes of *E. siderophloia*, and one (W_1) anthers which tend markedly toward those of *E. paniculata* (see Fig. III). They are described more fully with the syntypes of *E. siderophloia*. The sheet Bentham labelled *E. paniculata* has one fruiting and three flowering shoots—two of the latter with anthers near to *E. paniculata* (2 & 4 on sheet—4 is very similar to Sieber 468), the

*Mueller, in Eucalyptographia, placed *E. fasciculosa* F. Muell. under *E. paniculata* Sm. That distinct South Australian species is not now confused with it.

third with anthers tending more toward those found among the *E. siderophloia* syntypes.

The confusion between *E. siderophloia* Benth. and *E. paniculata* Sm. has continued in the identities assigned to Sieber's No. 468. The material under this number at Kew is close to *E. paniculata*. It was originally listed by Sieber as *E. ornata* (Flora 1825, Beil 1 : 138) without a description. Bentham cites this number (without mention of the name *E. ornata*) as *E. paniculata* Sm. (Fl. Aust. 3 : 211) and has labelled the Kew sheet accordingly, though he refers *E. ornata* Sieb. (without the number) to *E. pilularis* Sm. (Fl. Aust. 3 : 208). Maiden, however, mentions *E. ornata* Sieb. as a synonym of *E. siderophloia* Benth. (Crit. Rev. 1 : 326). Though there is some superficial similarity, the Sieber material in the Kew Herbarium is not close to any of the Kew syntypes of *E. siderophloia* (nor to those of Woolls' "Large-leaved ironbark" *E. siderophloia* var. *rostrata* Benth. which Maiden considers to be "the ordinary form of *E. siderophloia*", Crit. Rev. 1 : 324).

Sieber's plant is close to the type of *E. paniculata* Sm., though it differs subtly from it. The chief differences are that the Sieber specimen has a relatively broader leaf (6·5–10 cm. long, 1·5–2·0 cm. wide), the intramarginal vein is distinctly removed from the edge, the lateral veins anastomose to some extent, and are at irregular intervals of 1–5 mm., the umbels are 5–7 flowered, and the whole shoot is stouter and on a slightly larger scale. The stamens (see Fig. 1) are of the *E. paniculata* type—the outer ones sterile, and tapering to a non-glandular tip, the anthers of the fertile ones being of the rounded cuneate kind as are those of *E. paniculata* (see Fig. 1). There is, however, a slight amount of variation, and the gland is sometimes visible in the front. These differences are compatible with Sieber 468 being part of a hybrid swarm, and near to the element which is *E. paniculata* Sm. It remains to be seen whether the material Sieber collected under this number is uniform.

Further evidence that *E. paniculata* is associated with a hybrid complex is given by Maiden (Crit. Rev. 5 : 225) where he comments that the three units into which R. T. Baker suggested splitting *E. paniculata*—*E. paniculata*, *E. fergusoni*, R. T. Baker, and *E. nanglei* R. T. Baker—run into one another. This is supported by his comment (ibid p. 227) that some of the fruits illustrated e.g. Pl. 57 fig. 9e, were not typical of the trees from which they were taken—a feature which is more likely to be found in hybrids.

The plant Blakely describes under *E. paniculata*, Key. Euc. No. 537, differs from the type in having larger leaves (7–13 × 1·5–3 cm.) and buds (10 × 5 mm.), longer peduncles (10–20 mm.) acutely conical operculum, stamens usually all fertile, with anthers which may be subreniform in shape.

E. SIDEROPHLOIA *Benth. in Fl. Aust.* iii 220 (1866).

Syntypes in Herb. Kew. :

A. Ironbark, Moreton Bay, Queensland. Collected A. Cunningham No. 50.

B. Hastings River, N.S.W. Dr. Beckler, from Herb. Oldfield.

C. Hastings River, N.S.W. Collected Dr. Beckler, from Herb. Oldfield.

E. Hastings River, N.S.W. Collected Dr. Beckler. Originally labelled *E. ornata.*

W_1 W_2 W_3 on one sheet—" She Ironbark of Parramatta ", N.S.W. Collected by Woolls. Originally labelled *E. ornata.*

An additional specimen, D, from Macleay River, N.S.W., collected by Dr. Beckler, but not cited by Bentham, is mounted on the same sheet as C.

Each consists of one flowering shoot (except C, which has two) with buds, flowers, and leaves. The only fruits are unattached, mounted in a capsule on the sheet of Woolls' " She Ironbark ", and of two distinct forms—obovoid and globular truncate. They cannot be assigned with certainty to any specimen, hence are of little value for purposes of typification.

Syntypes in Herb. Melb. :

F_1 Hastings River, at Port Macquarie, Blackman's Point Road. Tree 20–25′ high. Collected by Dr. Beckler.

F_2 Hastings River. Young tree 20′ high. Collected Dr. Beckler.

G_1 " Ironbark on the road to Brisbane 12th Jan, 44." Collected Leichhardt.

These 3 syntypes are flowering sprays with leaves, buds and open flowers.

G_2 No locality. Collected Leichhardt—consists of two small sprays with fruits attached, and panicles of very juvenile buds. In absence of buds open flowers it cannot be compared with the other syntypes.

H_1 H_2 H_3 No localities, collected Woolls.

H_1 is two leaves and two separate panicles of fruit, H_2, one flowering panicle and a separate portion with two leaves, H_3 a large spray with a panicle of flowers and buds—originally labelled "Broad-leaved or He Ironbark. *E. resinifera*, gathered February ".

Syntypes not located :

N.S.W. Port Jackson, " Ironbark ", R. Brown and others.

" Ironbark ", C. Moore.

The composite description which follows, and the illustrations of anthers from single flowers in Fig. III show the amount of variation within and between the main syntypes of *E. siderophloia.* It is clear that they do not represent a good species.

The description covers the group ABCDE W_2 W_3, and, as far as can be seen from the descriptions available, F_1 F_2 G_1. D has been included as it is mounted on the same sheet as a specimen cited by Bentham. It belongs to the same group as the others, and its anthers are more uniform than those of any specimen Bentham mentioned. W_1 is excluded, as it is close to the *E. paniculata* end of the complex Woolls collected as She-Ironbark. G_2 is excluded because the material is insufficient for comparison with the other syntypes, H_1 and H_2 because material is inadequate for consideration as type, and H_3 because it is identical with shoots 1 and 5 of Woolls' Large-leaved Ironbark of Parramatta, part of the syntypes of *E. siderophloia* var. *rostrata* [Note—not the entity at present known as

E. siderophloia]. All specimens fit within the limits of the following characters ; distinctive or isolated ones are noted for the Kew syntypes.

COMPOSITE DESCRIPTION : *Branchlets* angled near the top, angles continuing below inflorescence in A and B. *Leaves* alternate, petiolate (petioles 1·0–2·2 cm. long), lanceolate to falcate lanceolate ; *length within range 3·5–18 cm., no shoot with range of more than 9 cm., ACD shortest, B longest ; breadth within range 1·3–3·1 cm., no shoot with variation greater than 0·9 cm., breadth increasing in order (C, D & A) →(B, E & W_3)→W_2 ; moderately thick ; *intramarginal vein* confluent with edge (B, C) *or* distinctly removed from it (A, E, W) *or* a mixture of both (D) ; distinct thicker lighter coloured edge to leaf ; midrib scarcely to distinctly (W_2) channelled above and raised below ; *lateral veins* ± distinct, at intervals < 1½ to 1–3½ mm. ; some anastomosing (BDEW_2) or none (A, C) ; angle with midrib from 30–45° (in C) widening in order D→(E & W_2)→A to 45–60° in B (amplitude of variation not more than 15° on one shoot).

Inflorescence terminal, paniculate, lowermost umbels or panicles frequently in axils of leaves ; umbels 3–6 to 6–11 flowered ; *peduncles* terete or flattened (ACDEW_2) or all flattened (B), 2–16 mm. long ; pedicels angular (winged in D), fairly stout (1–2 mm. wide), somewhat flattened in B. *Operculum* equal to calyx-tube (A, D), about 1½ times as long (B) or 1½–2 times as long (C) ; conical, acute, with tips blunt in A, B, fairly acute in C, D, rostrate in E. *Calyx-tube* hemispherical –E → obconical (A)—D → turbinate (BW_2)—C→ pyriform ; tapering into pedicel ABCDW_3) or faintly (W_2) or fairly distinctly (E) contracted into it ; angles on pedicel continue up calyx-tube, usually the whole length, but reduced to a slight line in E ; *calycine rim* fairly distinct in A & B, sometimes facing outwards in A, scarcely visible in the rest.

Stamens variable within one shoot (ABCEW_2W_3) or fairly uniform (D) ; outer stamens fertile (ACDE W_2 W_3—except for one staminode seen in W_3) or sterile, with glandular tips (B). For range of variation in shape of anthers see Fig. III. *Gland* not visible *or* immersed in tissues and sometimes visible posteriorly or terminally or through pores, *or* visible at apex or back ; when present elliptical to globular, ½–⅘ length of anther. *Filament* fairly stout, sometimes ± tapering at attachment to base of anther.

Fruit : the only fruit which can be assigned to any shoot with certainty is that at Melbourne (G_2) collected by Leichardt (no locality), but these shoots have only very immature buds which are inadequate for comparison with other syntypes. The fruits are obovoid-truncate, somewhat tapered into the pedicel, 8 × 7–8 mm.; calycine rim broad, facing ± outwards ; valves 4, exert, deltoid. *Seed* : nil.

Comparison of syntypes in Kew and Melbourne Herbaria :

F_1 is very similar to B_1 which was also collected at Hastings River by Beckler. They may be part of the same collection—the only one which may be represented in both places.

*N.B. flowering shoots.

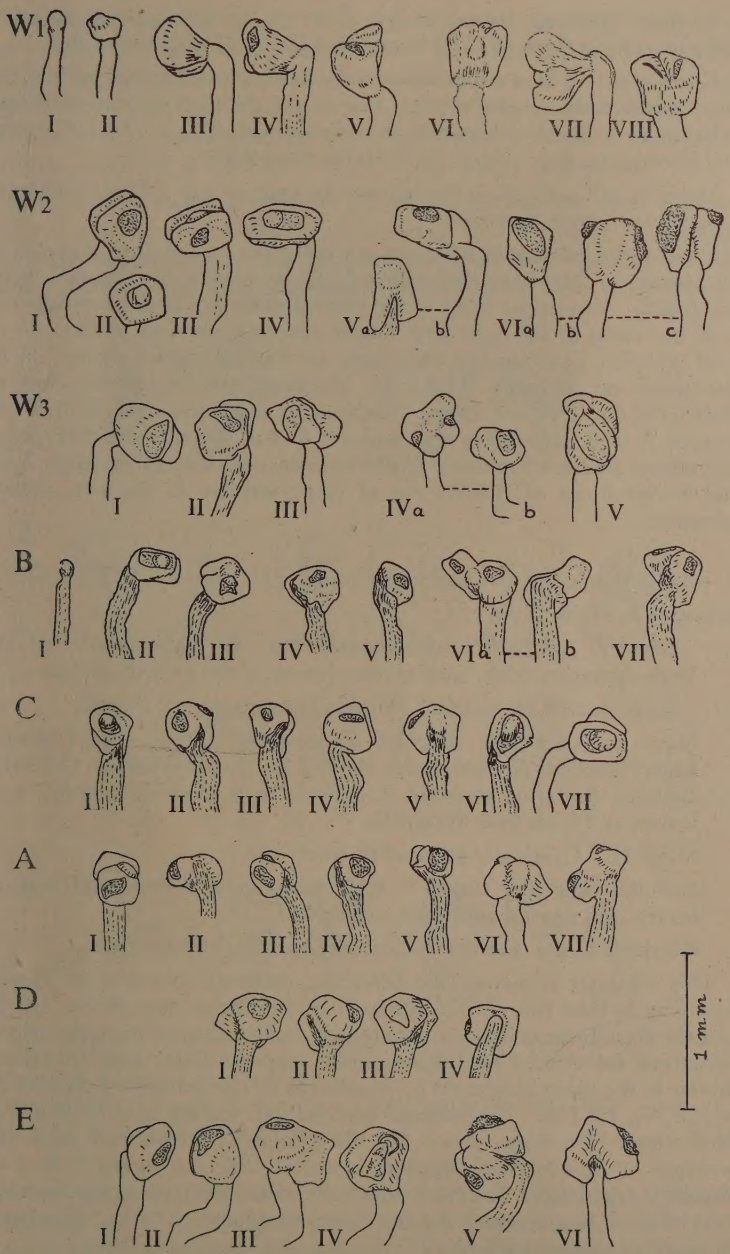

FIG. III. Representative stamens, and, where present, staminode tips, from single flowers of the Kew syntypes of *E. siderophloia* Benth. and additional specimen D. Note variation in stamen form within single flowers, and between the syntypes. W_1 stamens close to those of *E. paniculata*. Note glandular tips to staminodes W_1, no. I and B no. I. For key to specimens see text. a, b, c. different views of one stamen.

F_2 from Hastings River, seems to be of the same group as other collections from there (B C F) though not identical with any of them.

G_1 collected on the road to Brisbane by Leichhardt, appears to be of the same group as the other syntypes, though not identical with any of them. It has more distinctive characters in common with AW_2 W_3 from Brisbane and Parramatta than with B–D, from Hastings River.

Material of G_2 H_1 H_2 is inadequate for comparison ; H_3 is similar to part of var. *rostrata* syntypes.

None of the existing illustrations is wholly like any of these syntypes of *E. siderophloia*. Mueller's illustration in Eucalyptographia appears to be composite. The upper buds of the central shoot are near to syntypes A & B, but those at the right with longer opercula are near to shoots 2 & 3 of Woolls' Large-leaved Ironbark of Parramatta—syntypes of *E. siderophloia* var. *rostrata*. The fruits illustrated on the left are close to those of shoot 4 in the same collection. Leaves are near to those of syntype A of *E. siderophloia* and shoots 2 & 3 of the var. *rostrata* syntype mentioned above. Maiden's illustrations in both Crit. Rev. Gen. Euc. and Forest Flora of N.S.W. are of plants similar to the var. *rostrata* syntypes.

E. SIDEROPHLOIA var. (?) ROSTRATA *Benth. in Fl. Aust.* 3 : 220 (1866).

Syntypes in Herb. Kew. :

1. " Greater Ironbark ", Backhouse, No. 29. Maitland, N.S.W. Very immature buds, with mature leaves of two growth periods.
2. " Large leaved Ironbark ", Woolls, Parramatta. 2 sheets.

   Sheet I. Originally labelled *E. resinifera*. From Hb. Oldfield. Later labelled *E. siderophloia* Benth. by J. H. Maiden (8/1901). Includes flowering shoots 1 & 2, with buds, flowers (1 only), and leaves, and loose fruit in capsule.

   Sheet II. Originally labelled *E. ornata* var. ?

   Includes flowering shoots 3 & 5, with buds, flowers and mature leaves, and shoot 4 with fruit and leaves.

   All three sheets labelled " *E. siderophloia* var." by Bentham.

This material is mixed, the flowering material collected by Woolls involving at least two entities (shoots 1 & 5 differing from shoots 2 & 5) and the Backhouse collection apparently a third, though its buds are too immature for critical identification. It appears likely that it will be similar to the plant illustrated by Maiden as *E. siderophloia* in Forest Flora of N.S.W., Pl. 148. No material labelled var. *rostrata* is to be found at Melbourne. However, shoot H_3 there, already mentioned with the syntypes of *E. siderophloia* appears identical with the shoots 1 & 5 of Woolls' Large-leaved Ironbark which Bentham referred to var. *rostrata*. It is labelled *E. siderophloia* B., and " Broadleaved " or " He " Ironbark. *E. resinifera* gathered February ".

COMPOSITE DESCRIPTION OF WOOLLS' LARGE-LEAVED IRON BARK : (The main differences between the two entities—1 & 5 and 2 & 3—are listed separately after the description of the characters ±

in common). *Branchlets* angled (1 & 5) or somewhat angled (2 & 3) near apex. *Leaves* alternate, lanceolate to broad lanceolate, straight to falcate, petiolate (with petioles 1·5–4·0 cm. long), these leaves 12 to > 16 cm. long, midrib slightly channelled above and raised below; *intramarginal vein* obscure (1 & 5) to fairly distinct (3), ½ to 2 mm. from edge; *lateral veins* distinct (1 & 5) or ± distinct (2 & 3), ± regular to ± irregular.

Inflorescence a terminal panicle (1) to mainly axillary with a short terminal panicle (2); *umbels* within range 5–9 flowered; *peduncles* quadrangular or terete to slightly flattened, somewhat expanded at the top in 2, within range 9–20 mm. long; pedicels thick, terete to ± angled.

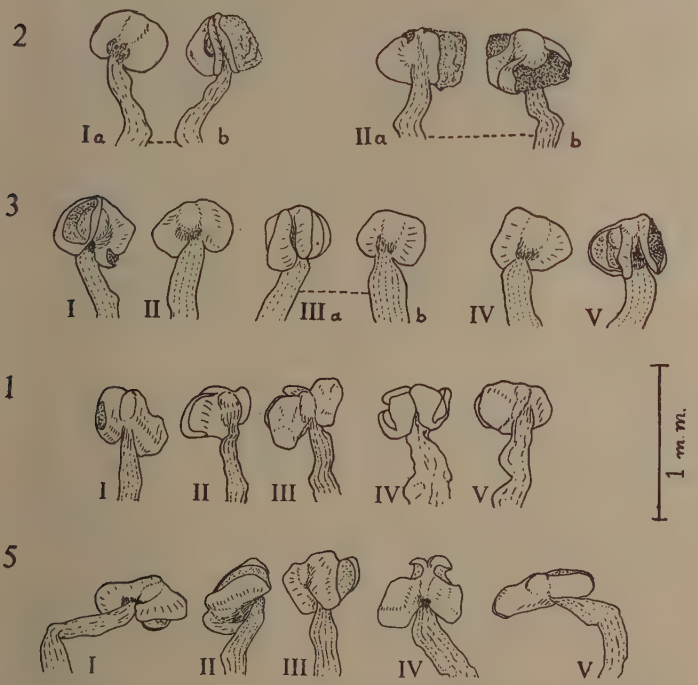

Fig. IV. Representative stamens from single flowers of the four flowering shoots at Kew collected by Woolls as Large leaved Ironbark, and included by Bentham among the syntypes of *E. siderophloia* var. (?) *rostrata*.

Note similarity of stamens of shoots 2 and 3, and their relative uniformity.

Shoot 5 : II–IV typical, I and V unusual.

Anthers all fertile. Filament attachment basal or sub-basal. *Filament* stout, may be ± tapering at apex. *Fruits* (shoot 4 and loose fruits) obovoid truncate, tapering into pedicel (4) or distinctly contracted into it (loose); 7–8 × 7–8 mm.; not angled (loose) or with 2–3 angles on pedicel continuing part way up side of fruit (4); calycine rim broad (½ + mm.), facing ± outwards; valves 4–5, exsert (strongly so in loose fruits), deltoid, apiculate. *Seed* nil.

Chief characters in which the two entities differ :

	Shoots 1 & 5	Shoots 2 & 3
Leaves	thick up to 4+ cm. broad	fairly thick 2–3 cm. broad
Pedicels	4–7 mm. long	2–4 mm. long
Calyx-tube	5–6 mm. long, almost campanulate, tapering into stout pedicels.	3–4 mm. long, obconical to hemispherical, usually ± contracted into pedicel.
Calycine rim	facing outwards, 0·5–1 mm. broad, slightly lighter in colour than the tube.	facing upwards, narrow (in 3 only, 2 has only buds).
Operculum	(in 5, 1 has none) rostrate, stout ; × 2 calyx-tube ; 12 mm. long, 8 mm. wide at base, narrowing into beak 5 mm. from base ; beak nearly 1·5 mm. broad, tip blunt.	narrow conical, sometimes curved, tapering into a fairly blunt point, × 3–4 calyx-tube ; 10–15 × 3·4 mm.
Stamens (see Fig. IV)	variable	fairly uniform.
anthers	some wing-like ellipsoid or angular or projecting at right angles ; dehiscing by slits extending half to full length of anther.	± ellipsoid or sometimes angular; dehiscing by means of slits extending full or almost full length of anther
gland*	ellipsoid to subglobular, terminal, ± immersed in tissues, $\frac{1}{3}$–$\frac{3}{4}$ length of anthers.	ellipsoidal to subglobular, occupying upper part of connective, visible at top and back, $\frac{1}{3}$–$\frac{3}{4}$ length of anther.
Fruit	none attached to these shoots.	

(*see note on p. 193).

The only illustration for *E. siderophloia* var. *rostrata* as such is Maiden's (Crit. Rev. Pl. 47, fig. 20 a and b), where buds and anthers from the Sydney specimens of Woolls' Large-leaved Ironbark are shown. The buds are close to the shoots 2 & 3 of that collection described here ; the anthers have already been commented on (p. 193). Some material of the

kind included under var. *rostrata* by Bentham has been figured under *E. siderophloia*—see above.

REPUTED SYNONYMS OF E. SIDEROPHLOIA :

1. *E. ornata* Sieb. nomen nudum—This is close to *E. paniculata* Sm. (see p. 7).
2. *E. fibrosa* F. Muell. in J. Linn. Soc. 3 : 87 (1858).

   This species has been referred to *E. siderophloia* var. *rostrata* by Bentham (Fl. Aust. 3 : 220), *E. siderophloia* (i.e. var. *rostrata*) by Maiden (Crit. Rev. 1 : 325) and *E. siderophloia* by Mueller himself in Eucalyptographia, though actually his own name was published several years before Bentham's. Blakely (Key. Euc.) cites *E. fibrosa* as a synonym of *E. pilularis* Sm., an opinion held by Maiden (Crit. Rev. 1 : 34), before he considered Mueller's later statement (Eucalyptographia) that the bark was much less stringy than that usual on stringybark trees. It may be noted that although Bentham (Fl. Aust.) and Mueller (in Eucalyptographia) both state that *E. fibrosa* was described from shoots with young buds only, Mueller actually included fruit and seed in the original description.

   Two sheets of what is apparently part of the type collection of *E. fibrosa* are in the Kew Herbarium. The original labels read (1) " *E. fibrosa F. Mueller* Stringybark Tree Brisbane River Dr. M. Dec. 1856 ". (2) " bis Brisbane River Stringybark *E. fibrosa* Mueller ". Maiden has labelled the former " This seems to me *E. siderophloia* J.H.M.", and Bentham the latter " *E. siderophloia* Benth. var." Both sheets have leafy shoots with fairly well developed buds containing well-formed anthers. Small differences between the shoots on the two sheets suggest that they represent collections from different trees. They are not identical with any of the syntypes of *E. siderophloia* var. *rostrata* Benth., but the variation shown is compatible with their being part of that complex. Their exact status cannot be determined until the complexes have been fully investigated in the field.

CONCLUSIONS

Variation, within the one individual, of anther and leaf characters to an extent beyond that which is usually regarded as normal in Eucalyptus species has been observed. The possibility that such variation may indicate hybridity warrants further investigation.

The type specimen of *E. paniculata* Sm., a single flowering shoot, is relatively consistent in its characters, and although it may belong to a hybrid complex, it would then appear to be near one of the parents. Evidence which suggests that the type of *E. paniculata* is associated with a hybrid complex is cited.

Sieber 468 (*E. ornata* Sieb nom. nud.) is near to *E. paniculata* Sm.

From the inconsistencies within and between the syntypes of *E. siderophloia* Benth. at Kew and Melbourne, it appears that Bentham gave this name to mixed material which is largely hybrid in origin. It is

doubtful whether any of the syntypes represents an uncontaminated species. Further studies of the complex in the field and the herbarium along the lines followed by Brett, 1937 and unpub., and Pryor 1950, 1951, will be necessary before any final conclusions can be drawn. Ordinarily the question of selecting a lectotype could then be considered. In this case, however, where the name *E. siderophloia* Benth. has been applied for many years to a unit which is not among the existing syntypes, this would lead to considerable confusion. The only way to avoid long-persistent error seems to be the rejection of the name as a nomen ambiguum. ("Art. 75 The name of a taxon must be rejected if it is used with different meanings, and so becomes a long persistent source of error.")

The existing syntypes of *E. siderophloia* var. *rostrata* are mixed, involving at least two entities in Woolls' Large-leaved ironbark alone. (These may be linked by a fruiting shoot in the same collection.) Part of this is the material Maiden has selected as the " ordinary form of *E. siderophloia* and includes the kind of material to which the name is currently applied. Both entities differ sufficiently from the *E. siderophloia* complex selected by Bentham to be regarded as separate species. Again, thorough investigation in the field to define the units involved is necessary.

E. fibrosa F. Muell. appears to belong to the complex of which the syntypes of *E. siderophloia* var. *rostrata* are part.

From the evidence available in the literature, and that from the specimens at Kew, it appears clear that the hybrid complex *E. siderophloia* is linked with that associated with *E. paniculata*. The specimens Woolls collected as She Ironbark appear to belong here. If this is so, it is evidence of the occurrence in the field of a hybrid between a member of the major taxonomic group Terminales (as defined by Blakely), and a member of one of the other groups. There may be hybridization between the portion of *E. siderophloia* var. *rostrata* with long opercula (identified by Maiden as *E. siderophloia*) and what is known as *E. resinifera* Sm. The possible linkage of the two entities within the *E. siderophloia* var. *rostrata* syntypes has already been mentioned. The relation between either of them and the *E. siderophloia* group is not clear.

In view of the distribution of these complexes in coastal districts along the greater part of eastern New South Wales and well into Queensland, with ascent on to the tablelands in places, the task of sorting out the entities involved is likely to be one of some magnitude, and may involve hybrid swarms covering a range of parents.

The writer wishes to record her thanks to Sir Edward Salisbury, the Director, and Dr. Turrill, Keeper of the Herbarium, Royal Botanic Gardens, Kew, for providing facilities for work there, and to Dr. R. Melville for continued advice and criticism, for making the drawings and describing type material in the Melbourne Herbarium.

Bibliography.

Anderson, Edgar. 1948. Hybridization of the Habitat. Evolution 2 : 1–9.

—— 1949. Introgressive Hybridization. Wiley & Sons, New York.

Baker, R. T. & Smith, H. G. Research on Eucalypts. 1902.

Bentham, G. Fl. Aust. 3 (1866).

Blakely, W. F. Key to the Eucalypts. Sydney, 1934.
Brett, R. G. 1937. Papers & Proc. Roy. Soc. Tas. 1937 : 75–110.
Maiden, J. H. Crit. Rev. Genus Eucalyptus, 1 ; 1908 ; 6 : 1924.
—— Forest Flora of N.S.W. 4 : (1910).
Mueller, F. von . J. Linn. Soc. 3 : 87 (1858).
—— Eucalyptographia (1879–80).
Pryor, L. J. 1950. A hybrid Eucalyptus. Proc. Linn. Soc. N.S.W. 75 : 97.
—— 1951. Genetic Analysis of some *Eucalyptus* spp. Proc. Linn. Soc. N.S.W. 76 : 140–8.

George Forrest, Plant Collector.*—Until the last quarter of the nineteenth century the flora of the greater part of China was virtually unknown to western botanists. Maximowicz's Index Florae Pekinensis and Index Florae Mongolicae (Prim. Fl. Amur. 468–486 : 1859) provided an enumeration of the plants of northern China, while Bentham's Flora Hongkongensis (1861) accounted for the extreme south. A few collections had been made at places along the east coast, but of the rest of China practically nothing was known.

During the years 1868–1870 Père David journeyed to western Szechuan and Sikang ; from 1885 to 1888 Augustine Henry thoroughly explored western Hupeh and the adjacent part of Szechuan ; while from 1882 to 1892 the Abbé Delavay worked in the mountains of northwestern Yunnan. Their collections revealed the existence of an amazingly rich flora, and opened a new era so far as Chinese botany was concerned.

The significance of this in relation to horticulture was quickly realised, and the botanical explorers were soon followed by collectors whose primary object was to obtain seeds, bulbs, etc., wherewith to introduce the more decorative plants into cultivation in this country, though they too collected herbarium specimens. The first of these plant-collectors was E. H. Wilson, who during the years 1899–1910 made four expeditions to the regions explored by David and Henry. He was soon followed by George Forrest who first went to China in 1904 to work in Delavay's terrain, and who in the course of the next 28 years travelled and collected extensively throughout northwestern Yunnan and the adjacent parts of Sikang, Tibet and Burma. Wilson wrote a number of books about his travels, while an account of his collections was given in the three volumes of Plantae Wilsonianae. Forrest wrote only three or four articles ; the published lists of his plants (Notes Roy. Bot. Gard. Edinb. VII, XIV, and XVII) give only the names and field-notes ; while the descriptions of the vast number of new species he collected are scattered through many volumes. There is thus no single work that could be regarded as a

*The Journeys and Plant Introductions of George Forrest V.M.H. Edited by Dr. J. Macqueen Cowan, C.B.E. Published for the Royal Horticultural Society by the Oxford University Press, 1952. pp. xi + 252, frontispiece portrait of G. Forrest, 5 coloured plates, 100 photographs. Royal 8vo. 30/- net.

memorial to the man who did so much more than once at the risk of his life for horticulture and botany, and it was to fill this gap that the present volume was compiled.

George Forrest died suddenly on January 6th 1932, while out shooting, a few miles from Tengyueh, and the book starts with the obituary which Sir William Wright Smith contributed to the Rhododendron Society Notes in 1932. At the time of his death Forrest was preparing to return home at the end of what he had intended should be his last expedition. A most interesting chapter by Mr. E. H. M. Cox tells the story of his various journeys and the way he actually worked. Much of the information is presented in the form of extracts from Forrest's letters and articles, and reading them one regrets the more that he never wrote a full account of his travels. Forrest employed a considerable number of collectors, and the organisation of their work absorbed much of his time. They were mostly Mossos from a tiny hamlet, U-lu-kaev ("Snow Mountain Village"), at the foot of the Likiang Range, and Forrest trained them so well that he could send them to collect on their own long distances away and still obtain uniformly excellent results in the shape of ample and superbly prepared herbarium material and large quantities of seeds.

The rest of the book consists of a series of articles on Forrest's material of genera where he made some notable introduction. This, of course, has led to the omission of many genera to which Forrest made considerable contributions e.g. *Rosa, Iris, Saxifraga, Primularis*, etc. Nevertheless 58 genera are included in addition to the orchids and conifers. Pride of place is given to the genera in which Forrest was most interested, namely *Rhododendron* and *Primula*, but, with a few exceptions, the object so far as the other genera are concerned has been to compress the information within the compass of a single page. Of *Rhododendron* Forrest gathered 5675 numbers representing several hundred species, of which no fewer than 307 were described from his material. The account, by Dr. Cowan, does not attempt to do more than refer to the more outstanding species, but even so it is an impressive record, and there is quite an appreciable amount of information about the plants in the wild and under cultivation. The same is true of Dr. Fletcher's review of *Primula*, of which Forrest gathered some 154 species or subspecies. The accounts of the other genera were written by various members of the staff of the Royal Botanic Garden, Edinburgh, and, as might be expected, the work is somewhat uneven. There is, however, something of interest in each article, and together they give a good idea of the plants Forrest obtained. One noticeable feature is the number of species which had been first collected by Delavay. Forrest cannot have missed much which the Frenchman had found. Mistakes are very few, but at least one author does not know the difference between "further" and "farther"—and Buchanan-Hamilton did not collect "for Wallich" as is alleged on page 125.

The book is particularly well illustrated. There is a portrait of Forrest as frontispiece, five coloured pictures of plants, and 100 photographs, many of them taken by Forrest himself in Yunnan. Altogether it is a not unworthy tribute to one of the greatest plant collectors of all time.

J. Robert Sealy.

THE RUSTAM HERBARIUM, 'IRAQ.—PART V.
SYSTEMATIC LIST (contd.)*

by R. A. Blakelock and others.

Orchidaceae
(det. V. S. Summerhayes).

Ophrys bornmuelleri *M. Schulze*

Seri Hassan Beg, near Rowanduz, 750 m., in moist grassy habitat in the shade of a bush, 10 May 1933, *Cuckney* 3836.

This species has apparently not previously been recorded from 'Iraq.

Ophrys sintenisii *Fleischm. & Bornm.*

River Tanjero, near Sulaimaniya, 600 m., 30 March 1932, *Ludlow-Hewitt* 1930 ; Zawita Gorge, 900 m., in deep soil on high rocky ledges above the gorge, 23 April 1932, 2179.

Orchis anatolica *Boiss.*

Zuweta [? Zawita], 900 m., 19 April 1931, *Ludlow-Hewitt* 1541 ; Zawita Gorge, 900 m., in deep soil on high rocky ledges, 23 April 1932, 2177.

Orchis palustris *Jacq.*

Qara Tepe, in tufts in a marsh, 12 Feb. 1931, *Ludlow-Hewitt* 446.

Orchis punctulata *Stev. ex Lindl.*

River Tanjero near Sulaimaniya, 600 m., one specimen only, 30 March 1932, *Ludlow-Hewitt* 1192.

Orchis simia *Lam.*

Zuweta [? Zawita], 19 April 1931, *Ludlow-Hewitt* 1554 ; Zawita, 900 m., in deep soil on high rocky ledge above the gorge, 23 April 1932, 2180.

Orchis tridentata *Scop.*

Zawita Gorge, 900 m., on deep and dry soil on sloping rocky ledges near gorge, 23 April 1932, 2114.

Scitaminaceae.

Canna sp.

Basra, cultivated in gardens (probably not indigenous, but the plant is now widely distributed in gardens throughout lower 'Iraq), 15.12.31, 1613.

Iridaceae.

Crocus aerius *Herbert* (det. B. L. Burtt).

Ser Amadia, 1800 m., corm said to be eaten, native name pichuk, 28.3.31, 1268.

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*Continued from Kew Bull. **1950,** 460 (1951).

Gladiolus atroviolaceus *Boiss.*

Zawita Gorge, 900 m., in deep soil on high rocky ledges above the gorge, fl. deep blackish-purple, 23.4.32, 2176.

G. illyricus *Koch.*

Persian border near Arl Girt Mt. (Kurdistan), 2700 m., purple red, Aug. 31, *Ludlow-Hewitt* 2375A ; Arl Gird Dagh, 2700 m., among *Astragalus* bushes, rare, deep purplish-red flowers, 24.7.32, *Guest and Ludlow-Hewitt* 2949.

G. segetum Gawl.

Daltawa, in cultivated fields, bright carmine pink, 4.4.31, 1438 ; do., in cornfields, colour bright carmine pink, native name khuwaisah (n.b. I have reason to believe that this is the correct name, unsalān being used indiscriminately for other Liliaceae), 22.4.32, *Darwish Hadari* 1438A ; Qizil Robat, in cornfields, bright carmine, native name, 28.3.32, 1763 ; Rowanduz Gorge, c. 600 m., carmine pink flowers, 10.5.33, *Cuckney* 3887. There is considerable variation in flower size in these specimens.

Iris aucheri (*Baker*) *Sealy* (*I. sindjarensis* Boiss. et Haussk.).

Rowanduz Gorge, 23.3.30, 579 ; Amadia, 1050 m., on high rocky ledges of the cliff by a waterfall in a gorge, pale mauve, native name rais balūk, 26.2.31, 1221 ; Marmarut (nr. Rowanduz), 900–1200 m., on rock plateaux, pale bluish to greyish white, 19.4.32, 2072 ; without precise locality, May 33, *Ludlow-Hewitt* s.n.

I. persica *L.*

Jabal Hamrin, nr. Table Mountain, 12.2.31, *Ludlow-Hewitt* 1070.

I. sisyrinchium *L.*

Altun Kupri–Kirkuk road, 27.3.30, 632 ; between Dohuk and Mosul, 300–450 m., very common in cultivated fields, along roadside etc., 1.4.31, 1277 ; Daltawa, in cultivated fields, native name ʻinsalān, 6.4.31, 1436 ; Syrian Desert (between Jabal Tanf and the Euphrates), Mar.–Apr. 33, *Edmonds* 3792.

I. susiana *L.*?

Ser Amadia, 180 m., native name gūl hairū (K.), 1932, *Majid Mustafa* 3597.

There are no colour notes with this specimen so that it cannot be named with certainty (see Dykes, The Genus Iris 109 (1913)). In its other characters it is a good match for Kotschy 339, which is presumably the specimen cited by Dykes l.c. 120.

AMARYLLIDACEAE.

Ixiolirion montanum (*Labill.*) *Herb.* (*I. pallasii* F. et M.).

Tuz, in cultivated fields, 4.4.31, 1497 ; nr. Mosul (in cornfields), 2700 m., 18.4.31, *Ludlow-Hewitt* 1545 ; Mandali (?) in a cornfield, 26.3.32, 1723 ; Kani Mazi, nr. Khanaqin, 210 m., 29.3.32, 1865 ;

Rowanduz Gorge, c. 600 m., 30.4.32, *Ludlow-Hewitt* 2351 ; Jazira Desert, 20.4.33, *Edmonds* 3823 ; Razinook (m. Rowanduz), Kurdistan, 10.5.33, *Cuckney* 3833 ; Ain Ghazal (Mosul Province), 360 m., in a field, 28.4.33, 4073 ; Balad Sinjar, 372 m., 28.4.33, 4115 ; Balad Sinjar–Tal Afar, 330 m., on roadside strip of grazing land, 28.4.33, 4141 ; do., 330 m., on semi-natural steppe, 28.4.33, 4166 ; Ain-al-Husan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.33, 4218.

Narcissus tazetta *L.* flore pleno.

Grown at Baghdad from bulbs obtained at Amadia, 1200 m., Feb. 31, 447 ; Amadia, 1170 m., 27.3.31, 1384.

Sternbergia fischeriana (*Herb.*) *Roem.*

Amadia, 1170 m., native name susān, 26.3.31, 1237 ; among bulbs from 'Iraq in Sir Edgar Ludlow-Hewitt's garden at Chippenham, Wilts., flowers yellow, 23.3.34, *Ludlow-Hewitt* 5012.

Dioscoreaceae.

Tamus communis *L.*

Ryatt Valley (foot of Arl Gird Dagh), 1050 m., growing over bushes by a stream, 20.7.32, 2771 ; Zawita (nr. Dohuk), 840 m., by a spring, 25.7.33, 3688.

Liliaceae.

Allium akaka *Gmel.*

Marmarut Mt. (Rowanduz Area), 900–1200 m., 19.5.32, 2069 ; Arl Gird Dagh, 3000 m., on the stony mountain side, pinkish, 22.7.32, *Guest and Ludlow-Hewitt* 2891 ; Marmarut Mt., nr. Rowanduz, 900–1200 m., 10.5.33, *Cuckney* 3839.

The most useful literature on this genus is :—

Regel, A. : Alliorum adhuc cognitorum monographia (1875).

Feinbrun, N. : *Allium* Sect. *Porrum* in Palestine and the neighbouring countries in Pal. Journ. Bot. J. Ser. **3,** 1–21 (1943).

—— Further studies on *Allium* of Palestine and the neighbouring countries, l.c. **4,** 144–157 (1948).

Stearn, W. T. : Notes on the genus *Allium* in the Old World in Herbertia **11** (1944), 11–34 (1946).

Vvedensky, A. I. (trans. H. K. Airy Shaw) : The Genus Allium in the U.S.S.R. in Herbertia **11** (1944), 65–218 (1946).

A. ampeloprasum *L.*

Makatu (nr. Mandali), on a stony plain, May 30, 862 ; Mandali, 10.5.30, 891 ; Kani Dolman hills, Kirkuk, 390 m., dry stony rounded hill top, 30.4.33, 4305.

Allium arlgirdense *Blakelock* sp. nov. ; a *A. rubello* M.B. caulibus supra medium foliatis, foliorum vaginis pubescentibus et foliis contortis distat.

Herba 7–12 cm. alta. *Bulbus* ovato-subglobosus, 1–2 cm. altus, 0·8–1·5 cm. latus, tunicis (interioribus ?) albo-membranaceis. *Caulis* erectus, teres apicem versus in sicco sulcatus, glaber, 0·75–2 mm. crassus, usque ¾ foliatus. *Foliorum vaginae* albo-scabride-pubescentes. *Folia* 2–3, linearia, contorta, fistulosa, semicylindrica, glabra vel raro in nervis scabrida, usque 3·5 cm. (vel plura) longa, c. 1 mm. lata. *Spatha* membranacea, 2-valva, persistens, apice obtusa mucronata, 6–8 mm. longa. *Umbella* capsulifera, hemispherica, densa, 12–35-flora, 1·5–2·5 cm. in diam. ; pedicelli basi bracteolati, filiformes, in umbellis maturis 7–10 mm. longi. *Perigonium* lati campanulatum tepala in sicco praecipue in nervo rosea, oblonga, obtusa vel subacuta 4 mm. longa (exteriora paullo minora), 1·5 mm. lata (in fructu 2 mm. lata). *Stamina* haud exserta ; filamenta simplicia basi coalita et perigonio adnata, interiora triangularia, 3 mm. longa, basi 1·5 mm. lata, exteriora lineari-triangularia 2·5 mm. longa, basi 0·5 mm. lata ; antherae flavae, 1 mm. longae. *Stylus* haud exsertus, 0·75–1 mm. longus, stigmate subcapitato indiviso. *Ovarium* ovato-oblongum, 2 mm. longum, 1·5 mm. latum, loculo biovulato. *Capsula* obcordata, albo-membranacea, reticulata, 3 mm. longa, 4 mm. lata. *Semina* valde verrucosa (immatura ?), oblonga, apice rotundata, basi oblique attenuata, complanata, minute punctata, nigra, 3 mm. longa, 1·5 mm. lata.

N. 'Iraq. Arl Gird Dagh, 3000 m., on the mountain side, 21.7.32, *E. R. Guest and E. R. Ludlow-Hewitt* 2829.

The leaves in our specimens are broken off short of their apex, so that their length is unknown. *A. rubellum* M.B. is used in the sense defined by Vvedensky l.c. p. 160, including var. *parviflorum* Ledeb. p.p. *A. arl-girdense* differs from *A. scabrellum* Boiss. et Buhse in its lower growth, the stem leafy for ¾ of its length, contorted leaves and blunter tepals.

A. dilutum *Stapf.*

Khanzad Valley nr. Arbil, 27.3.30, 619 ; Dohuk, 450 m., in cultivated fields, 1.4.31, 1386.

Type material (Persia ; inter Kazwin et Zerschk, 1882, *Pichler*) at Kew has three ovules in each loculus. 619 has the same number. Two flowers of 1386 have been dissected ; one showed two ovules in each loculus ; the other flower had two ovules in two of the loculi and three ovules in the third loculus. This species shows some resemblance to the specimens tentatively named as *A. jenischianum* (2149, 2242). *A. dilutum* is distinguished, however, by less numerous, shorter and more unequal pedicels.

A. eriophyllum *Boiss.*

Tuz, 210 m., in cultivated fields, 6.4.31, 1412 ; Qizil Robat, in a cornfield, 28.3.32, 1779 ; Chemchemal, 300 m., 28.3.32 *Ludlow-Hewitt* 1926 ; Tal Afar, 715 m., on compact soil by the roadside, 26.4.33, *Guest, Eig and Zohary* 5114.

[**A.** aff. **eriophyllo** *Boiss.*

Persian Gulf : Bahrain, Mar. 31, *Ludlow-Hewitt* 1133.

This specimen differs from the specimens cited above under *A. erio-*

phyllum Boiss. in the smaller perianth with the segments less keeled towards the base].

A. jenischianum *Regel* e descr ?

Rowanduz, 900 m., 19.4.32, 2149 ; Dohuk-Zakho, 25.4.32, 2242.

2242 has 3–4 ovules in each loculus. In 2149 two flowers were dissected, one showed 3–4 ovules in each loculus, the other only two ovules in each loculus.

A. laceratum *Boiss. et Noë.*

Zawita Gorge, 900 m., 23.4.32, 2198.

A. notabile *Feinbrun.*

Zawita, 1005 m., on rocky bluff, 1.8.33, 4960.

A. aff. **olivieri** *Boiss.* e descr. ?

Mosul, 300 m., in cultivated fields, 2.4.31, 1486 ; do., in a wheat field, native name basal ja'if (="rotten onion"), 9.4.32, *Yussef Lazar* 3351 ; nr. Tauq, 195 m., on steppe soil, 13.4.33, *Guest, Eig and Zohary* 5094.

A. orientale *Boiss.*

Arl Gird Dagh, about 3000 m. (?), cultivated at Westbrook House, Bromham, Wilts., from bulbs brought from Kurdistan in 1932, 16.5.34, *Ludlow-Hewitt* H9/1934.

The length of the tepals varies considerably in the material at Kew.

A. aff. **orientale** *Boiss.*

Ain-al-Husan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.33, 4214.

This specimen is immature.

A. aff. **phaneranthero** *Boiss. et Haussk.* ? e descr.

Nr. Mandali, Kauma Sang, 9.5.30, 789 ; Kirkuk Province, useful for flavouring food, native name sîr or hāmūrsāq, 14.5.33, *Ali Effendi Hadari* 3950. These specimens show no leaves, nor do they agree perfectly with Feinbrun's description of *A. phanerantherum.*

A. schoenoprasum *L.*

Arl Gird Dagh, 3000–3300 m., on the mountain side, 22.7.32, *Guest and Ludlow-Hewitt* 1049.

A. suworowi *Regel* ?

Arl Gird Dagh, cult. Wilts., 16.5.34, *Ludlow-Hewitt* s.n.

The specimen lacks leaves or bulb, but otherwise appears to be this species, which has previously been recorded from 'Iraq. (Nábělek in Publ. Fac. Sci. Univ. Masaryk **105,** 38 (1925)). It shows a marked resemblance to the Persian *A. jesdianum* Boiss et Buhse.

A. viride *Grossh.* e descr.

Zawita range, 1050 m., rocky mountain slope, 25.7.33, 4459.

This specimen lacks leaves, but it is *A. viride* according to Feinbrun's key l.c. 1943. It matches the description of *A. viride* as given by Vvedensky (trans. Airy Shaw) in Herbertia **11,** 180 (1946), except that umbel and tepals are somewhat smaller.

Asparagus verticillatus *L.*

Zawita, Kurdistan, N. of Dohuk, 900 m., fruit a red berry which has fallen off specimens, 10.10.31, 1564 ; do., 840 m., 25.7.33, 3690 ; do., c. 900 m., on rocky slope, 30.7.33, 4806.

Asphodelus aestivus *Brot.* (*A. microcarpus* Viv.).

Khanzad Pass near Arbil, 22.3.30, 556 ; Khanzad Valley (nr. Arbil), c. 450 m., growing profusely on the sides of a wadi and extending down into the dry stony bed, 17.4.32, 556A ; Zakho Valley, 600 m., fairly dense association covering the hillside, 24.4.32, 2010.

A. tenuifolius *Cav.*

Almost certainly collected near Mosul or Kirkuk, 152 ; [Oman (Arabia) : Ras al Khima, Mar. 31, *Ludlow-Hewitt* 1130] ; Jabal Hamrin (nr. Table Mountain), 150 m., on sandy soil on rocky ledges, 28.3.32, 1794 ; Southern desert, W. of Zubair, on compact sandy soil, covered by small stones and grit, 8.4.33, *Guest, Eig and Zohary* 5040.

Asphodeline brevicaulis (*Bert.*) *J. Gay.*

Mosul-Tal Afar, 360 m., in fields, orange yellow flowers, 28.4.33, 3960.

Bellevalia decolorans *Bornm.* e descr.

Marmarut Mt. (Rowanduz area), 900–1200 m., on the stony mountain side, 19.4.32, 2066.

These specimens show young capsules and the withering remains of the perianth. Flowering material from 'Iraq is shown in "Sulaimaniya, Apr. 20, *Graham* 651". *B. shiraziana* Parsa is very closely related. There is a monograph of this genus by Feinbrun in Pal. Journ. Bot. J ser. **1,** 131–142 (1938) ; **1,** 336–409 (1940).

B. glauca (*Lindl.*) *Kunth.*

Sumaicha (nr. Samarra), Feb. 30, 391 ; plain at foot of Jabal Hamrin nr. Khashan Ahman [?], 21.3.30, 510 ; Tuz, 29.3.30, 638 ; Zawita Gorge, Kurdistan, 900 m., 23.4.32, 2637A.

B. kurdistanica *Feinbr.*

Amadia, c. 1050 m., in fields in the valley and in deep loamy soil pockets on the hillside, 26.3.31, 1210 ; Kirkuk, 210 m., in cultivated fields, 4.4.31, 1381.

Guest 1212 from the same locality is the type (Feinbr. l.c.t. XIX, fig. 16).

B. aff. **kurdistanicae** *Feinbr.*

Amadia, 1140 m., in pockets of soil on the cliff face, 25.3.31, 1208.

Probably only stunted plants (5–11 cm. high) of *B. kurdistanica.* Each plant has only a single scape.

B. latifolia *Feinbrun.*

Daltawa, in cultivated fields, picked when green and sold in the bazaar for children for pop it, hence the name " taqaiq " (onomatapoeic), 10.4.31, *Darwish Hadari* 1919 ; between Mosul and Dohuk, 300–450 m., 1.4.31, 1279. [Pickled material from Rowanduz Gorge, " H812/33 " probably belongs to this species].

1279 is from the date and locality the same gathering as the type at Jerusalem.

B. macrobotrys *Boiss.*

Amadia, 1020 m., in cultivated fields and orchards in the valley, 28.3.31, 1265 ; Qizil Robat, in cornfields, native name idhan-as-saklailah, 26.3.32, 1764.

B. mosheovii *Feinbrun* e descr.

Tursak (nr. Mandali), at the edge of a cornfield, eaten by pigs, native name basailah (" little onion "), 26.3.32, 1740 ; Naft Khana, 150 m., on the stony hillside, 29.3.32, 1855.

Colchicum fasciculare (*L.*) *Boiss.*

Table Mountain (Jabal Hamrin), 22.2.31, *Ludlow-Hewitt* 445.

C. aff. **fasiculare** (*L.*) *Boiss.* et **szovitsii** *F. et M.*

Nr. Table Mountain (Jabal Hamrin), 60 m., 20.3.32, *Ludlow-Hewitt* 1676.

This specimen shows a capsule 2·5 cm. long and 1 cm. wide. The capsule of *C. szovitsii* is described by Stefanoff (Monographie der Gattung Colchicum L., 1926) as 1.5–3·5 cm. long ; that of *C. fasiculare* as 1–1·2 cm. long. The bulb is not shown in our plant, but the collar formed by the bulb tunics is present at the base of the leaf-sheaths and it is short (2·5 cm.) as in *C. fasiculare.* In *Ludlow-Hewitt* 1068 (*C. szovitsii*) the collar is 6–8 cm. long. 445, 1068 and 1676 are here named according to Steffanoff's monograph. Dr. Feinbrun has examined these three specimens and named them as " *C.* sp. vel *C. szovitsii* (*C. fasciculare* (L.) Boiss.)"

C. kotschyi *Boiss.*

Diana, nr. Rowanduz, Kurdistan, 750 m., white or pale mauve, 12.10.31, 497 ; Shaikh Adi (N. of Mosul), 750 m., 10.10.31, 1655 ; between Hatra and Baiji, on high, flat, alluvial (?) plain nr. Wadi Tharthar, native name 'unsalān, 17.10.32, 3543.

C. szovitsii *F. et M.*

Jabal Hamrin (nr. Table Mountain), 12.2.31, *Ludlow-Hewitt* 1068.

Fritillaria assyriaca *Baker.* (det. W. B. Turrill).

Amadia, 900–1800 m., in soil pockets on the mountain sides, orange-blue flowers, native name tarai raiwi (K.), 28.3.31, 1211.

F. imperialis *L.* (det. W. B. Turrill).

Amadia, 1050 m., bright red flowers, 27.3.31, 1240 ; Marmarut Mt. (Rowanduz Gorge), 900–1200 m., on the mountain side, 19.4.32, 2073.

F. persica L. (det. W. B. Turrill).

Marmarut Mt. (Rowanduz), 900–1200 m., on the stony mountain side, 19.4.32, 2074.

Gagea assyria *Terrac.*

Diana nr. Rowanduz, Kurdistan, 21.3.30, 712 ; Amadia, 1140 m., in deep pockets of soil on the mountain side, 26.3.31, 1214.

The most recent monographic work on *Gagea* is :

Pascher, A. A. ; "Ubersicht über die Arten der Gattung Gagea" in Sitz. Deutsch. naturw.-medic. Ver. Böhm " Lotos " no. 5, 1–23 (1904).
Terracino, A., "Gagearum species florae orientalis" in Bull. Herb. Boiss. Ser. II, **5,** 1061–1076, 1113–1128 (1905) ; **6,** 105–120 (1906).

G. aff. **chloranthae** (*M.B.*) Sch.

Rowanduz Gorge, 23.3.30, 592 ; Amadia, 1140 m., in pockets of soil on the rocky cliff face, 25.3.30, 1209.

In 1209 the flowers are larger (10–18 mm. long) than is usual in this species. 592 is too poor material to be more accurately named.

G. persica *Boiss.*

Marmarut, 1200 m., on the stony mountain side, plentiful, 19.4.32, 2075.

G. reticulata (*Pall.*) *R. Sch.*

N. of Samarra (by old Turkish Bridge), Mar. 30, 401 ; Qara Tepe Mar. 30, 1000 ; Syrian Desert (between Jabal Tanf and the Euphrates), Mar.–Apr. 33, *Edmonds* 3788 ; Balad Sinjar, 402 m., on strip of roadside grazing, 28.4.33, 4116.

Hyacinthus orientalis *L.*

Amadia, 1170 m., native name sumbul, 26.3.31, 1238.

Lloydia aff. **rubroviride** (*Boiss. et Kotschy*) *Baker* ?

Jindian nr. Rowanduz, 25.3.30, 747.

The tepals show signs of having been tinged with red towards the margins in the upper part. The pedicels are shorter and more hairy than in *L. rubroviridis*. Our material is too imperfect for more accurate identification.

Muscari comosum (*L.*) *Mill.*

Kirkuk, in a cornfield, 16.4.32, 2001 ; Zakho Valley, 600 m., among rocks on the mountainside, 25.4.32, 2265 ; Rowanduz Gorge, c. 600 m., 30.4.32, *Ludlow-Hewitt* 2355 ; Zawita Gorge, 900 m., 23.4.32, 2637 ; Marmarut Mt. nr. Rowanduz, Kurdistan, 900 m., 10.5.33, *Cuckney* 3835 ; Makhlat, 165 m., among rocks under a cliff, 29.4.33, 4277 ; Rowanduz Gorge, Aug. 32, " 700.32A " [and material in pickle].

M. aff. **comoso** (*L.*) *Mill.*

Mosul, 270 m., in cultivated fields, 2.4.31, 1346 ; Zawita Gorge, 900 m., in deep red soil in sloping rocky banks, 23.4.32, 2178 ; Rowanduz Gorge, 30.4.32, 2355A ; Sharaban, in a cornfield, 27.3.32, 2652.

These differ from *M. comosum* in the sterile flowers being sessile or very shortly pedicellate (2 mm. long). 2652 has sterile flowers which are blue in the dried state ; in the other numbers they show no signs of coloration.

M. commutatum *Guss.*

Marmarut Mt. (Rowanduz area), 900–1200 m., on the stony mountain side, 19.4.32, 2067 ; Ain-al-Hasan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.32, 4204, 4216.

M. longipes *Boiss.*

Nr. Kirkuk, 300 m., on the road to Baba Gurgur oil wells, on light sandy soil, 4.4.31, 1370 ; Tuz, 210 m., in cultivated fields, 6.4.31, 1413 ; Mandali, in cornfields, native name 'unsalān, 26.3.32, 1721 ; Balad Sinjar–Tal Afar, 330 m., 28.4.33, 4167 ; Ain-al-Husan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.33, 4217 ; Kani Dolman hills, Kirkuk, 390 m., on dry stony rounded hill top, 30.4.33, 4303; hort., 5.5.33, *Ludlow-Hewitt* s.n.

M. racemosum (*L.*) *Lam. et DC.* s.l.

Amadia, 1020 m., in fields in the valley under trees etc., 26.3.31, 1213.

M. aff. **racemoso** (*L.*) *Lam. et DC.*

Diana nr. Rowanduz, Kurdistan, 26.3.30, 710 ; Bazian Pass (Kurdistan), 1.4.32, 375 m., *Ludlow-Hewitt* 1196.

Material too poor for more accurate identification.

Muscari sp.

Syrian desert (between Jabal Tanf and the Euphrates), Mar.–Apr. 33, *Edmonds* 3794.

This shows some resemblance *M. caucasicum* Griseb. and to *M.* aff. *comoso* above, but the material is too poor for accurate identification.

Ornithogalum iraqense *Feinbrun.*

Almost certainly collected near Mosul or Kirkuk, 143 ; Qara Tepe, March 30, 428 ; Sulaimaniya, 815 m., 30.3.32, *Ludlow-Hewitt* 1925 ; Kaleh Shirwana (N. of Khanaqin), 210 m., 7.3.32, *do.* 2376.

428 is cited by Feinbrun in Pal. Journ. Bot. J. Ser. **2,** 146 (1941).

O. narbonense *L.* subsp. **brachystachys** (*C. Koch*) *Feinbr.* l.c. 135.

Tursak (nr. Mandali), very common in cornfields, native name 'unsalān, 26.3.32, 1741.

O. aff. **narbonense** *L.*

Dohuk, 450 m., in a cornfield, 21.4.32, 2161.

This specimen does not agree with any of species described by Feinbrun l.c. 137. The leaves are persistent, up to 15 mm. broad and slightly ciliate at the margin. The perigonum is under 10 mm. long.

O. platyphyllum *Boiss.* (*O. montanum* Cyr. var. *platyphyllum* Boiss., *O. cuspidatum* Bert.).

Chemchemal, 300 m., 29.3.32, *Ludlow-Hewitt* 1924; Dohuk, 450 m., in cultivated fields, 1.4.31, 1385; Qizil Robat, in a cornfield, 28.3.32, 1775; Shaqlawa, 900 m., 17.4.32, 2020.

Turrill retains this as a variety of *O. montanum* (Bot. Mag. 9420 (1935)). Feinbrun gives it specific rank (l.c. 145).

O. pyrenaicum *L.*

Chia-i-Mandali (nr. Walza), 2100 m., on a hillside in a ditch, 19.7.32, *Guest and Ludlow-Hewitt* 2734.

O. ulophyllum *Hand-Mazz.*

Jabal Hamrin, 150 m., 24.3.31, 1203; Ain-al-Husan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.33, 4215.

Ornithogalum sp.

Almost certainly collected near Mosul or Kirkuk, 142; Suliman Beg (nr. Tuz), in cultivated fields, 210 m., 6.4.31, 1420; Daltawa, 6.4.31, 1442; Mandali, in a cornfield, 26.3.32, 1746; Rowanduz Gorge, c. 600 m., 30.4.32, *Ludlow-Hewitt* 2356; Dohuk, in a wheat field, native name basailah (= " little onion "), 26.4.32, *Yussef Lazar* 3345.

Material at Jerusalem under no. 142 has been identified by Feinbrun l.c. p. 145 as *O. schelkovnikovii* Grossh. although she notes that it does not agree perfectly with Grossheim's description. The specimens at Kew have been named by Dr. Feinbrun as probably *O. narbonense* subsp. *brachystachys*.

Scilla autumnalis *L.*

Rowanduz Gorge (Kurdistan), 750 m., in pockets of soil on a rocky ledge, 12.10.31, 451.

S. persica *Hausskn.*

Suwara Tukka (Kurdistan), nr. Dohuk, 1200 m., grown at Baghdad from bulbs collected in Kurdistan in Apr. 31, Apr. 32, *Ludlow-Hewitt* 1193; Suwara Tukka, 900 m., on a grassy slope, 23.4.32, 2181.

S. aff. **persicae** *Hausskn.*

Amadia, 1020 m., in cultivated fields and orchards in the valley, 28.3.31, 1222.

1222 differs from *S. persica* in the ciliate leaf-margins, shorter pedicels, and the inflorescence oblong-linear not pyramidate. It is possibly a new species, but as the flowers are not very well preserved, it seems better to await further material rather than describe it here.

S. sibirica *Andrews* (*S. cernua* Red.).

Marmarut (nr. Rowanduz), 900–1200 m., on the stony mountain side, 19.4.32, 2077.

The specimens have only one flower in each inflorescence.

S. sibirica *Andrews* ?

Rowanduz Gorge, Kurdistan, 26.3.30, 590 ; Jindian, nr. Rowanduz, 750 m., on vertical cliff face by Sayyid Taha's cave, *Guest, Eig et Zohary*, 17.4.33, 5111.

Material too poor for more accurate identification. There is a revision of the Caucasian species of *Scilla* by Grossheim in Monit. Bot. Gard. Tiflis n.s. **3-4,** 178–201 (1927).

Tulipa stapfii Turrill (*T. cuspidata* Stapf in Denschr. Acad. Wiss. Wien **50,** 17 (1885) non Regel (1884) (det. J. R. Sealy).

Kirkuk, 240 m., in foothills, 28.3.32, *Ludlow-Hewitt* 1933 ; Sulaimaniya, 1500 m., on top of hills behind the town near snow, 30.3.32, *do.* 1934 ; Marmarut (nr. Rowanduz), 900–1200 m., on the stony mountain side, very common, 19.4.32, 2068 ; Rowanduz Gorge, 750 m., 18.4.32, 2104 ; Balad Sinjar–Tal Afar, 330 m., on roadside strip of wasteland, 28.4.33, 4140 ; Khani Mazi, near Khanaqin, flowers golden yellow, 15.3.32, *Ludlow-Hewitt* 1674 ; Khanaqin area, March 33, 4053 ; nr. Kirkuk, 420 m., on bare denuded earth hills, 13.4.33, *Guest, Eig and Zohary* 5099 ; without precise locality, May 33, *Ludlow-Hewitt* s.n.

The species normally has red flowers and the plants from the Khanaqin region seem to be a yellow-flowered form comparable with those known in other species of the genus (e.g. in *T. montana*, *T. linifolia*, *T. greigii*, etc.). In all these plants the red colour is the result of the presence of an anthocyanin pigment in the sap of the epidermal cells in addition to a yellow ground colour due to plastids in the cells of the mesophyll (Hall, The Genus Tulipa, 21, 1940). The forms with yellow flowers are plants where the anthocyanin is absent. Though *T. stapfii* is widely distributed in western Persia (from Tabriz in the north to south of Shiraz) and in adjacent north-eastern 'Iraq, the yellow form is so far known only from the Khanaqin area. In addition to the records cited above, it has also been collected in the same district but over the border in Persia, 27 miles west of Khanaqin, by *Cowan and Darlington*, no. 174.

Juncaceae.

Juncus bufonius *L.*

Nr. Mandali–Ain Nebbi Tehran, 9.5.30, 773.

J. fontanesii *Gay.*

Seri Hassan Beg. 1800 m., by a ditch on swampy ground, 24.7.32, 3021.

J. glaucus *Ehrh.*

Kirkuk Sulaimaniya, foothills, 26.5.30, *Paterson* 807 ; Qara Tepe, at the edge of a swift stream, 120 m., 15.4.32, 1954 ; Arl Gird Dagh, 1800 m., in a stream, 21.7.32, 2819.

J. maritimus *L.*

Nr. Mandali, Ain Nebbi Tehran, in a small marsh by the spring, 9.5.30, 766 ; Siba nr. Abadan, on the edge of a creek, native name risal, 13.12.31, 1612 ; Daltawa, used for chairs, etc., native name asail, 26.5.32, 2452 ; in the Jazira (Wadi Tharthar), in stagnant water, native name yissal, 17.10.32, 3557.

TYPHACEAE.

Typha angustata *Bory et Chaub.*

Nr. Qalat Sali, very common in the marshes, reed for building houses etc., making mats, etc., native name bardi, 13.12.31, 482 ; nr. Zawita, 900 m., in a small swamp by the stream, 10.10.31, 1665.

482 shows only leaves but is probably this species.

ARACEAE.

Arum conophalloides *Kotschy.*

Nr. Gowair Ferry (River Zab), 140 m., a small clump of *Arum* by roadside, 2.4.31, 1334.

Biarum carduchorum (*Schott*) *Engl.*

Diana nr. Rowanduz (Kurdistan), 750 m., 12.10.31, 498.

Colocasia antiquorum *Schott.*

Baghdad Tree Nursery, 17.9.20, *Paranjpye* 19. Cultivated.

Eminium intortum (*Soland*) *O. Ktze.* var. **typicum** *Engl.* in Pflanzenr. **IV, 23F,** p. 129 (1920) (*Helicophyllum rauwolffii* (Blume) Schott).

Arbil, 22.3.30, 551 ; Kirkuk Sulaimaniya, 300–600 m., 28.3.32, *Ludlow-Hewitt* 1927 ; Umawara (nr. Razinook), in a field in the valley, 19.4.32, 2063.

E. intortum (*Soland*) *O. Ktze* ?

Nr. Dohuk (N. of Mosul), 340 m., only one specimen resembling no. 551A, but with a larger " flower " about 7 cm. long when fully open and a different kind of leaf of which two are sent, 1.4.31, 1280.

This specimen has leaves as much divided as in *E. spiculatum* (Blume) O. Ktze. Only one specimen in the Kew Herbarium shows leaves divided as much as this (Arbil, Apr. 20, *Graham* 691). Graham's specimen has the smooth spathes of *E. intortum.* Our specimen is without any lamina to the spathe and might belong to either species.

ALISMACEAE.

Alisma lanceolatum *Withering* (*A. stenophyllum* (Asch. et Graebn.) Samuelsson).

Daltawa, in marshes, dangerous plant to sheep, native name kizaibrah, 26.5.32, 2441.

There is a monograph of *Alisma* by G. Samuelsson in Ark. Bot. **24A**, no. 7 (1932).

CYPERACEAE (det. E. Nelmes).

Cyperus malaccensis *Lam.* Illustr. **1,** 146 (1791).

Basra, 10.29, 306.

C. longus *L.* var. **pallidior** *Kükenth.* in Engl. Pflanzenreich, IV, **20,** 100 (1935). (*C. longus* L. var. *pallidus* Boiss., non Boeck.).

Amadia, 1200 m., by a millstream at Sulaf, 2.8.33, 3768.

C. rotundus *L.* sp. Pl. ed. I, 45 (1753).

Near Mandali, Ab-i-Naqt River, 9.5.30, 920 ; Rustam, 16 May 1931, *Yussef Lazar* 1167 ; near Mahmudiya (Latifiya Estate), on irrigation channels, etc., 16.5.32, 2393 ; Diyala River at Rustam, on mud flats left by receding river in autumn, 24.9.32, 3505.

C. rotundus *L.* f. **latimarginatus** *Kükenth.* in Engl. Pflanzenreich, IV, **20,** 112 (1935).

Baghdad, July 1929, 189 ; Aziziya, in sorghum field, 17.9.32, 3477.

C. fuscus *L.* Sp. Pl. ed. I, 46 (1753).

Ain Sifni (N. of Mosul), 450 m., common weed in rice fields, 10.10.31, 1650 ; near Zawita, 900 m., in a rice field, 10.10.31, 1661 ; Rowanduz Gorge (Kurdistan), 600 m., near the stream in a marshy place, 12.10.31, 485 ; Rustam by Diyala River, on mud flats left by receding river in autumn, 24.8.32, 3506 ; Rustam, along the river foreshore, native name sa'ad, 29.10.32, *Yussef Lazar* 3589.

C. difformis *L.* Cent. Pl. **2,** 6 (1756).

Near Zawita, 900 m., in a rice field, 10.10.31, 1660.

C. pygmaeus *Rottb.* Descr. et Icon. 20, t. 14, fig. 4, 5 (1773). (*C. michelianus* (L.) Link subsp. *pygmaeus* (Rottb.) Aschers. & Graebn. Synops. II, **2,** 273 (1903), *Juncellus pygmaeus* C. B. Clarke in Hook. f. Fl. Brit. Ind. **6,** 596 (1893).)

Karada (Baghdad), on sand dunes left by receding river, 8.10.30, 1039 ; Baghdad, on the sandy foreshore left by the receding Tigris River, 14.7.32, 3221 ; Suq-as-Shiyukh, in water and wet places, very useful fodder plant, native name zarair gaba, ? Apr.–? June 32, *Qaimaqam of Suq-as-Shiyuk* 3305 ; Kut, above the river's edge, 17.9.32, native name khinaizrah, *Yussef Lazar* 3495 ; Rustam (River Diyala), common along banks of receding river in autumn, 24.9.32, 3499 ; Na'maniya, on mud flats left by the receding River Tigris, 29.10.32, 3585.

C. distachyos All. Fl. Pedem. Auct. 48, t. 2, fig. 5 (1789).

(*Juncellus distachyos* Turrill in Kew Bull. 1926, 375).

Kifri, edge of millstream, March 1930, 376.

Eleocharis palustris (L.) *Roem. et Schult.* Syst. Veg. **2**, 151 (1817).

(*Scirpus palustris* L. Sp. Pl. ed I, 70 (1753)).

Near Felluja, cultivated land, native name 'abairah, 6.3.30, 965 ; Daltawa, in marshy places, native name matakh, 26.5.32, 2431.

Fimbristylis dichotoma (*L.*) *Vahl*, Enum. Pl. **2,** 287 (1806).

(*Scirpus dichotomus* L. Sp. Pl. ed I, 50 (1753).)

Amara marshes (Majar canal), native name felîfilah, 14.12.31, 1620 ; Baghdad, on sandy foreshore left by receding River Tigris, 14.7.32, 3222 ; Diyala River at Rustam, common on mud flats left by receding river in autumn, 24.8.32, 3501 ; Namaniya, on mud flats left by the receding River Tigris, 29.10.32, 3583.

Scirpus triqueter *L.* Mant. **I,** 29 (1767).

Near Tuz, in a salt marsh, 29.3.30, 669 ; Dohuk, in a stream, native name zāl, 26.4.32, *Yussef Lazar* 3344.

S. maritimus *L.* Sp. Pl. ed. I, 51 (1753).

Qizil Robat, in a marsh, 30.3.32, 1893 ; do., in a cornfield on the edge of a swamp, 15.4.32, 1960 ; Daltawa, in marshy places, 26.5.32, 2429 ; Daltawa, eaten by horses and water-buffalo, native name sijil, 26.5.32, 2439.

Carex diluta *Marsch.–Bieb.* Fl. Taur.–Cauc. **2,** 388 (1808).

Amadia, 1020 m., in marshy place in valley, 31.3.31, 1445 ; Dolosur (Sulaimaniya), on mountain pastures throughout the province, spring plant eaten by all animals, native name zellawarda, 15.4.32, 2425.

C. orbicularis *Boott.* in Proc. Linn. Soc. **I,** 254 (1845).

Arl Gird Dagh, 3000 m., on wet grassy patches by a lake, 22.7.32, 2855.

C. divisa *Huds.* Fl. Angl. ed. I, 348 (1762).

Atrush, Kurdistan, 885 m., on red marl banks, open pine forest, 13.7.33, 4390.

C. stenophylla *Wahlemb.* in Vet.–Acad. Handl. Stockholm, **24,** 142 (1803).

Ain-al-Husan (nr. Sinjar), 315 m., on open *Poa* steppe, 28.4.33, 4198.

C. pseudofoetida *Kükenth.* in Mitth. Bot. Ver. Thür. N. F. **15,** 4 (1900) (nomen solum) et in Bot. Tidsskr. Kobenhavn, **28,** 225, fig. I (1907).

Near Felluja, on " haswah " land, native name nimis, 6.3.30, 956 ; Amadia, 1050 m., common on grassy steppes, 27.3.31, 1262.

GRAMINEAE.

The account of the Grasses will be published later by Mr. C. E. Hubbard.

CONIFERAE.

Pinus halepensis *Mill.* var. **brutia** (*Ten.*) *Henry* in Elwes & Henry, Trees of Great Brit. and Ireland **5,** 1100 (1910).

Toweit Valley, May 30, *Paterson* 850 ; Zawita (N. of Dohuk), Kurdistan 900 m., 31.3.31, 1327 ; Atrush, 885 m., on red marl banks (open pine forest), 13.7.33, 3636 ; Zawita, c. 900 m., 25.7.33, 3698 ; Atrush, 885 m., on red marl banks in open pine forest, seedling showing natural regeneration, 13.7.33, 4405 ; do., 840 m., on rocky mountain slope, 26.7.33, 4482 ; do., 1110 m., on rocky mountain slope, 27.7.33, 4501 ; do., 1020 m., pine forest on steep red marl slope, 28.7.33, 4635 ; do., 1080 m., on rocky limestone slope, 28.7.33, 4664 ; do., 1125 m., on rocky limestone slope, 4680 ; do., 1020 m., on red limestone scree soil, 29.7.33, 4740 ; do., 825 m., on rocky slope, 30.7.33, 4808.

Juniperus oxycedrus *L.*

Amadia–Dohuk, 600–1200 m., very common, 31.3.31, 1329, 1329A ; Zawita, 930 m., on steep limestone crags, 27.7.33, 4522, 4522A ; do., 1080 m., on rocky limestone slope, 28.7.33, 4657 ; do., 1140 m., in pine forest, 29.7.33, 4719 ; do., 990 m., in small rocky ravine, 30.7.33, 4776 ; do., 725 m., on rocky slope, 30.7.33, 4818 ; do., 1020 m., in pine forest, 30.7.33, 4832 ; do., 1230 m., in open oak forest, 30.7.33, 4859.

J. oxycedrus *L.* ?

Zawita, 740 m., on rocky mountain slope, 26.7.33, 4485.

Specimen very poor, but probably this species.

GNETACEAE.

Ephedra alata *Decne* (det. B. L. Burtt et P. Lewis).

Southern Desert on hard sandy soil, covered with pebbles in *Haloxylon* association, near Jaliba, 8.4.33, *Guest, Eig and Zohary* 5071 ; between Zubair and Ur, sandy desert, 8.4.33, *do.*, s.n.

E. foliata *Boiss.et Kotschy* ?

Nr. Felluja, on " haswah " land, native name arqal husan, 6.3.30, 950.

Specimen very poor.

PTERIDOPHYTA (det. F. Ballard).

Adiantum capillus-veneris *L.*

Kirkuk, by a waterfall near a mill, 16.4.32, 1991.

Anogramma leptophylla (*L.*) *Link.*

Khanaqin, 210 m., under shady overhanging rocky ledges in a gulley, 29.3.32, 1866.

Asplenium viride *Huds.*

Arl Gird Dagh, 3300 m., under damp overhanging rocks, 22.7.32, 2879.

Cheilanthes pteridioides (*Reich.*) *C. Chr.*

Khanaqin, 210 m., under shady overhanging ledges of rock in a dry gulley, 29.3.32, 1867 ; Rowanduz Gorge, 750 m., on overhanging rocky ledges near a waterfall, 18.4.32, 2112 ; Makhlat, 165 m., among rocks under a cliff, 29.4.33, 4270.

Ceterach officinarum DC.

Rowanduz Gorge, 750 m., on rocks by a waterfall, 18.4.32, 2111.

Cystopteris fragilis (*L.*) *Bernh.*

Arl Gird Dagh, 3300 m., under wet overhanging rocks, 22.7.32, 2880 ; do., 2700 m., under rocks by springs and waterfalls, 24.7.32, 2963.

Salvinia natans (*L.*) *All.*

Amara marshes, very common on the surface of the water, 13.12.31, 1625.

Equisetum ramosissimum *Desf.*

Arl Gird Dagh, 1800 m., under rocks by a stream, 21.7.32, 2815.

Charophyta.

Chara vulgaris *L.* (det. G. O. Allen).

Rustam, in a water channel, native name madaid-al-mai, 12.7.32, 3413.

" It is in a very young state. I have no previous record from 'Iraq.; but it has a very wide distribution. G.O.A."

Additions and Corrections.

Some explanation is needed for so lengthy a list. Most of the specimens mentioned below, although they possess a Rustam Herbarium number, were not represented at Kew in the main collection, but were found in the collections of F. A. Rogers, some time after the greater part of this catalogue was prepared. The list of *Astragalus* was delayed by the need to ascertain that Dr. Eig's names were going to be published. Part I.

p. 376. Line 29 under **Anemone coronaria** insert : " Qayara nr. Shargat, Mar. 1930, 355 ; Arbil, 553 ; Shaqlawa, 23.3.30, 569, 569 A "

p. 377. For " **D. hybridum** *Willd* " read " **D. micranthum** *Boiss. et Hoh.*"

p. 378. Line 17 under **Ranunculus asiaticus** insert : " Jabal Hamrin, 21.3.30, 504 ; Tuz, 29.3.30, 655.

p. 379. Line 5 under **Ranunculus kochii** insert : " Diana nr. Rowanduz, 26.3.30, 700 "

p. 380. Line 18 under **Leontice leontopetalum** insert : " Sumaicha, nr. Samarra, Feb. 1930, 390 ; Tuz, 29.3.30. 648 ".

p. 385. Line 18 under **Capsella bursa-pastoris** insert : " nr. Batas, Kurdistan, near a spring, 23.3.30, 578 ; nr. Rowanduz, 25.3.30, 729 ".

Line 22 under **Cardamine hirsuta** insert : " Rowanduz Gorge, 23.3.30, 605 ".

After line 32 insert : " **Cheiranthus cheiri** L. : Rustam, in gardens, Apr. 1930, 239 ".

p. 386. Add " **Coronopus squamatus** (*Forsk.*) *Aschers.* (*Senebiera coronopus* (L.) Poir.) : Mandali, 10.5.30, 884."

p. 387. Line 15 insert under **Erucaria hispanica :** " Nr. Mandali, Ab-i-Naqt River, 9.5.30, 906, 912 ".

p. 393. For " **Oligomeris subulata** (*Del.*) *Boiss.* " read "**Oligomeris linifolia** (*Vahl*) *Macbride* (*O. subulata* (Del.) Boiss.)"

p. 395. For " **Viola alba** *Boiss.*" read " **Viola alba** *Bess.*"

Insert " **Frankenia pulverulenta** L. : Nr. Mandali, Ab-i-Naqt, 9.5.30, 914."

p. 399. For " **G. rokejeka** *Del.*" read " **G. capillaris** (*Forsk.*) *C. Chr.* (*G. rokejeka* Del.)"

p. 403. For " **T. macrocarpa** (*Ehrenb.*) *Bge.*" read " **T. passerinoides** *Del.* (*T. macrocarpa* Ehrenb. (Bge))".

p. 406. After line 6 insert :

" **Hibiscus cannabinus** *L.*

Karada, cultivated, 9.7.20, *Paranjpye* 109 "

After line 24 insert :

" **Malva parviflora** *L.*

Jabal Hamrin, nr. Khashni Ahmar, 21.3.30, 519 ; Mandali, 10.5.30, 894 ".

p. 410. After line 18 insert :

MELIACEAE

" **Melia azedarach** *L.*

" Rustam Garden and common in most 'Iraq gardens, Oct. 1929, 313 ; Shaqlawa, trees, May 1930, *Paterson* 839 ".

p. 412. After line 6 insert :

" **Albizzia lebbek** *Benth.*

Rustam, Oct. 1929, 276 [presumably cult.]"

Line 8 insert under **Alhagi maurorum** : " Nr. Kut, Debouni, Sept. 1929, 210 ; Tigris River Bank, Karada, fls. red, 2.7.20, *Paranjpye* ".

p. 413. After line 13 insert :

" **Crotalaria juncea** L.

Basra, Oct. 1929, 293 [cult. ?]"

p. 412. After line 28 insert :

" **Astragalus amadiensis** *Eig* (det. A. Eig).

Ser Amadia, 1500 m., on open hillside at the top of Gulli Mazurka, 3.8.33, 4994.

A. ancistrocarpus *Boiss. et Hausskn.*

Jabal Darawishka (nr. Khanaqin), 240 m., 28.3.32, 1762.

A. ancistrocarpus *Boiss. et Haussk.* var. **brachypodus** *Eig* (det. A. Eig).

Kani Dolman hills, Kirkuk, 390 m., on dry rounded hill top, 30.4.33, 4339, 4363.

A. annularis *Forsk.*

Southern desert, W. of Zubair, on compact sandy soil covered by small stones and grit, 8.4.33, *Guest, Eig and Zohary* 5041.

A. bombycinus *Boiss.*

Southern Desert, W. of Zubair, on sandy compact soil, covered by small stones and grit, 8.4.33, *Guest, Eig and Zohary* 5022.

A. brachyceras *Ledeb.* (det. A. Eig).

Arbil, on top of a " til " (mound), 27.3.30, 624 ; Mosul, in a wheatfield, native name jabalah, 12.4.32, *Yussef Lazar* 3332.

624 is rather poor material and only doubtfully determined as this species.

A. brachystachys *DC.*

Between Sulaimaniya and Kirkuk, 300 m., 29.3.32, *Ludlow-Hewitt* 1920 ; Naft Khana, 150 m., on stony hillside, 29.3.32, 1860.

A. aff. **brachystachidi** *DC.*

Dohuk, native name gia dāsi (K.), 8.6.32, 3296. Material too poor for more accurate identification.

A. carduchorum *Boiss. et Hausskn.* subsp. **mandeliensis** *Eig* (det. A. Eig).

Chia-i-Mandali (nr. Walza), 1950–2100 m., on the mountain-side, low shrub with pink flowers, 20.7.32, 2685.

A. cephalotes *Banks et Sol.* (*A. andrachne* Bunge) var. **brevi-calyx** *Eig* (det. A. Eig).

Zawita Valley, 825 m., on red marl banks, 25.7.33, 4428A.

A. cruciatus *Link.*

Dohuk, 450 m., in cult. fields on gravel soil, 1.4.31, 1313 ; Arbil Prov., grazed by animals, native name akrainah, May 1933, *Mhd. al Radhi* 3876 ; Ain Ghazal (Mosul Prov.), 360 m., in a field, 28.4.33, 4081 ; Makhlat, 180 m., on open *Stipa* steppe, 29.4.38, 4260.

A. dactylocarpus *Boiss.* (det. A. Eig).

Nr. Kirkuk, on the road to Baba Gurgur oil wells, 300 m., on sandy hills, low bush, 25.3.31, 1202 ; Tuz, 210 m., in cult. fields, 6.4.31, 1406 ; Jabal Hamrin (nr. Injana), on light gypsiferous, 12.4.33, *Guest, Eig and Zohary* 5085.

A. deserti-syriaci *Eig* (det. A. Eig).

Nr. Arbil — Qosh Tapa ,405 m., in cultivated fields, 2.4.31, 1470.

A. diphtherites *Fenzl* subsp. **brachyanthus** *Eig* (det. A. Eig)

Nr. Ain Sifni, 450 m., stony hillside pastures, dwarf tufted shrub, 12.7.33, 4045.

A. fasciculifolius *Boiss.*

Naft Khana, on stony ground, 29.3.32, 1869 ; Shaqlawa, 900 m., common on the mountain sides, small spiny shrublet, 17.4.32, 2023 ; nr. Kirkuk, 420 m., on bare denuded earth hills, 13.4.33, *Guest, Eig and Zohary* 5101.

The fruiting calyces are about 2 cm. long in 1869, 5101 ; larger than is typical in this species (about 1·5 cm. long). 2023 has glabrescent calyces about 1·5 cm. long. The leaves are too small for these specimens to be included in *A. bruguieri* Boiss.

A. gossypinus *Fisch.*

Chia-i-Mandali, 1200 m., on a barren part of the hillside, dwarf shrubs forming cushions 6 ins. high, 20.7.32, 2752 ; Khanzad Pass, 690 m., on the stony hill top, dwarf shrub, 17.7. 32, 3003 ; Atrush, 785 m., on red marl slopes in open pine forest, 13.7.33, 3632 ; Altun Kupri, on Zab River, Bakhtiari conglomerate hills, low spiny tufted bush, 8.7.33, 4026 ; Zawita, 1020 m., in pine forest on steep red marl slopes, 28.7.33, 4638 ; do., 1140 m., in pine forest, 29.7.33, 4720 ; do., in open oak forest, 1230 m., 30.7.33, 4854 ; do., 1005 m., on rocky bluff, 1.8.33, 4968.

A. guestii *Eig* (det. A. Eig).

Atrush, 900 m., stony hillside, 13.7.33, 3640 ; Zawita, mountain slope, 1125 m., 28.7.33, 3764.

A. guttatus *Banks et Sol.* (*A. conduplicatus* Bertol).

Arbil, 375 m., in cult. fields, 2.4.31, 1453 ; Ain Ghazal (Mosul Prov.), 360 m., in fields, 28.4.33, 4058.

A. hamosus *L.*

Qizil Robat, in a cornfield, 15.4.32, 1965 ; Dohuk, 450 m., in a cornfield on stony land, 25.4.32, 2307 ; do., native name hangustir (K.), 8.5.32, *Mekki Beg* 3267 ; Arbil Prov., grazed by animals, native name akra-inah, May 1933, *Mhd. al Radhi*, 3875 ; Rustam Farm, 1932, s.n.

A. kurdicus *Boiss.*

Ser Amadia, 1800 m., on top of the ridge, 3.8.33, 4984.

A. kurdicus *Boiss.* subsp. **kurdorum** *Eig* (det. A. Eig).

Ser Amadia, 1800 m., on top of the ridge, 3.8.33, 4984.

A. microthamnus *Boiss. et Haussk.* (det. A. Eig).

Ghurfa Plain (nr. Injana), on sandy soil, 12.4.33, *Guest, Eig and Zohary* 5078.

A. mossulensis *Bge.*

Jabal Hamrin, 29.3.30, 688 ; do. (nr. Injana), 150 m., 6.4.31, 1431 ; do. (nr. Table Mt.), 150 m., on sandy soil on rocky ledges, small shrublet, 28.3.32, 15.4.32, 1793, 1793A ; Naft Khana, 150 m., on stony hillside, carmine pink flowers, 29.3.32, 1856.

A. noemiae *Eig* (det. A. Eig).

Ser Amadia, 1770 m., on mountain slope, 3.8.33, 4974.

A. pinetorum *Boiss.* ?

Arl Gird Dagh, 3000 m., on loose stony ground, 22.7.32, 2887.

Our plant has smaller leaves, and is more stunted than most of the material in Herb. Kew, but it agrees with Haussknecht's specimen from " Berytdagh Cataoniae 8000 ped." 2887 shows no fruits.

A. platyraphis *Fisch.* (det. A. Eig).

Mosul—Tal Afar, in a wheat field, native name hasla-al-baqar, 27.4.32, *Yussef Lazar* 3365 ; Balad Sinjar–Tal Afar, 330 m., on semi-natural steppe, 28.4.33, 4184.

A. russelii *Banks et Sol.*

Shaqlawa, Kurdistan, on a scree side, 23.3.30, 561 ; Jindian, nr. Rowanduz, 25.3.30, 741 ; nr. Kirkuk, 300 m., on the road to Baba Gurgur oil wells, on sandy soil, 4.4.31, 1373 ; Jabal Hamrin (nr. Table Mt.), on sandy soil, low stunted shrub, 30.3.32, 1897 ; Zawita Gorge, 900 m., on wide rocky ledges above the gorge, low dense spiny shrub, 23.4.32, 2192 ; Balad Sinjar–Tal Afar, 330 m., on semi-natural steppe, 28.4.33, 4185 ; Kani Dolman hills, Kirkuk, 390 m., on dry stony rounded hilltop, 30.4.33, 4292 ; Zawita, 825–1080 m., on red marl banks and rocky slopes, 25–29.7.33, 4428, 4651, 4746.

A. turrillii *Eig* (det. A. Eig).

Chia-i-Mandali (nr. Walza), all over the hillside above 1650 m. line approx., small spreading shrub forming flat spiny cushions, 1–2 ft. high, 18.7.32, 2654.

A. zubairensis *Eig.* (det. A. Eig).

Southern desert (between Zubair and Jaliba), on high sandy soil, strewn with small pebbles in *Haloxylon* association, 8.4.33, *Guest, Eig and Zohary* 5063.

Astragalus spp.

Nr. Felluja, on high stony land (" haswah "), native name sirr, 6.3.30, 949 ; Sinjar, c. 450–900 m. (?), fodder plant, native name gunjalîl, Apr.–May 32, *Mudir of Sinjar* 3110 ; Balad Sinjar–Tal Afar, 330 m., on semi-natural steppe, 28.4.33, 4183 ; Kani Dolman hills, Kirkuk, 390 m., on dry stony rounded hill top, 30.4.33, 4293.

Some of the recent work on Astragalus will be found under the following references :—

Eig, A. ; " *Astragalus* (Sect. *Pachyglottis*) : " Revision of the Palestinian Species " in Journ. Bot. **72,** 121–132 (1934).

Sirjaev, G. ; " Conspectus *Tragacantharum* (*Astragalus* L. subgenus *Tragacantha* Bge.) I, II, in Fedde Repert, Sp. Nov. **47,** 194–208, 225–261 (1939).

I am informed by Dr. Naomi Feinbrun, The Hebrew University, Jerusalem, that Dr. Eig's paper on *Astragalus* giving the names used above is to be published shortly."

p. 416. Line 15 for " neat " read " near ".

p. 419. After line 18 insert : " **Pisum sativum** L. Rustam, seed originally imported from England, Apr. 1930, 232 ".

p. 423. Lind 18 for " berves " read " nerves ".

p. 426. Line 29 for var. " *bornmuelleri* " read " **bornmuelleri** "

Line 37 under **Cerasus tortuosa** insert : " Almost certainly collected near Mosul or Kirkuk, 146 ".

p. 430. After line 10 insert " **Eucalyptus microtheca** *F. Muell.* (det. R. Melville). Rustam, Oct. 1929, 322."

p. 434. Line 44 insert under **Oliveria decumbens** :

" S. of Daima nr. Mandali, May 1930, 858 ".

p. 440. Line 4 for " 4830 " read " 4840 ".

Line 27 after " **tenuiflora** D'Urv." insert " var."

p. 442. For " **Pterocephalus involucratus** (S. et S.) Spreng." read **Pterocephalus brevis** *Coult.* (*P. involucratus* (*S. et S.*) *Spreng*)"

Part II.

p. 42. Line 43 under **Anthemis haussknechtii** insert : "Sulaimaiya foothills, May 1930, *Paterson* 820."

p. 48. Line 27 under **Centaurea rigida** f. **schizophylla** insert : " Tuz, 29.3.30, 660 "

p. 51. Line 39 for " subspecimen " read " subspecies ".

p. 54. For " **amorphoglossum** " read " **amorphoglossus** "

p. 58. Line 41 for " Boiss et Houssk." read "Boiss. et Haussk."

p. 60. Line 30 after " *P. damascena* Boiss " insert " nor *P. blancheana* Boiss."

p. 61. After " **P. myriophyllum** *C.A.M.*" insert " var."

p. 65. For " **Vicoa divaricata** (*Cass.*) *Benth. et Hook.*" read " **Vicoa pentanema** *Aitch. et Hemsl.* (*Pentanema divaricatum* Cass., non *Vicoa divaricata* Oliv.)"

Part III.

p. 519. Insert after line 5 : " **Limonium thouinii** (*Viv.*) *Kuntze* : Makatu, nr. Mandali, May 1930, 877."

p. 520. After line 29 insert : " **Nerium oleander** *L.* : Rustam, Oct. 1929, 278 ; nr. Arbil, 22.3.30, 557 ; Mandali, May 1930, 761."

p. 527. Line 41 insert under **Convolvulus reticulatus** : " Kirkuk Province, useful grazing plant, native name pîzhmîna, 14.5.33, *Ali Eff. Hadari* 3947 "

p. 529. After line 34 insert : " **Solanum nigrum** L. : Karada, Jan. 1920, *Paranjpye* 38 ; Rustam, Mar. 1929, 181 ; Basra, Oct. 1929, 304 ; Kut, Dec. 1929, 339."

p. 535. For " **V. aquatica** Bernh." read " **V. catenata** *F. W. Pennell* (*V. aquatica* Bernh.)" I am indebted to Mr. J. H. Burnett, Oxford, for his decision on the valid name of this species.

p. 550. After line 30 insert under **Teucrium divaricatum** : "Atrush, 983 m., on red marl banks in open pine forest, fls. mauve, 13.7.33, 3634 ".

p. 551. Line 2 under **Teucrium oliverianum** insert : "Nr. Mandali—Kauma Sang. 9.5.30, 762 ".

Part IV.

p. 444. Line 40 under **Paronychia kurdica** insert : " Makatu nr. Mandali, May 1930, 864 "

p. 445. Line 1 for " **Amaranthus angustifolius** *L.* subsp. **graecizans** (*L.*) *Thell* " read " **Amaranthus graecizans** L. (*A. angustifolius* Lam. subsp. *graecizans* (L.) Thell)."

p. 447. After **Seidlitzia rosmarinus** insert : " **Spinacia tetrandra** *Steven.*: Shargat (on the Zigurat mound at Ashur), Mar. 30, 403 " This species was not recorded from 'Iraq by Aellen (in Ber. Schweiz. Bot. Ges. **48,** 485–490 (1938)]. *S. turkestanica* Iljin is the only wild species he gives from 'Iraq.

p. 448. " **Antigonon leptopus** *Hook. et Arn.* (Polygonaceae) Garden as Basra, Oct. 1929, 282. A native of Mexico."

p. 449. Line 32 under **Rumex dentatus** subsp. **mesopotamicus** insert : " Mandali, cultivated fields, 10.5.32, 886 ".

Line 48 under **Rumex pulcher** subsp. **anodontus** insert : " Nr. Mahmudiya, (Yussefiya Canal), 9.5.30, 925A.

p. 450. Line 32 insert under **Elaeagnus angustifolia** : " Shaqlawa, tree from woods, May 1930, *Paterson* 842."

p. 454. After line 20 insert : " **Euphorbia heterophylla** L. : Garden at Basra, Oct. 1929, 284."

p. 455. After line 14 insert : " **Cannabis sativa** *L.* : Rustam, Nov., Dec. 1929, 328, 347."

p. 456. Line 17 under **Platanus orientalis** insert : " Shaqlawa, tree, May 1930, *Paterson* 840 ".

p. 460. After line 27 insert : " **Dicotyledones** spp. : Kut (Hor Suwaicha, marsh), Dec. 1929, 341A ; Jabal, E.N.E. of Seri Hassan Beg, 2100 m., 27.7.32, 2901A ; Jazira Desert, 20.4.33, *Edmonds* 3818 ; Balad Sinjar, 402 m., on roadside grazing strip, 28.4.33, 4119 ; Zawita, 1020 m., on steep red marl slope in pine forest, 28.7.33, 4637 ; do., 770 m., on red marl banks, 1.8.33, 4881."

The Vegetation of British Guiana.*—British Guiana has an area of 83,000 square miles and, apart from the coastal strip, is mostly very sparsely inhabited. The flora and vegetation are of great interest and the summary of what is known of the latter by D. B. Fanshawe, of the Colonial Forest Service, is an excellent and readable account. The physiography, geology, soils, land usage and settlement, and climate are adequately considered. The history of our knowledge of the flora is outlined and comparisons are made with the floras of neighbouring countries. The plant communities are classified, according to the scheme proposed by J. S. Beard, under six formation-series : Rain Forest (with one formation) ; Seasonal Forest (with four formations) ; Dry Evergreen Forest (with six formations) ; Montane Forest (with three formations) ; Marsh

*The Vegetation of British Guiana. A Preliminary Review, Imperial Forestry Institute, University of Oxford, Institute Paper, No. 29, 1953. 10/-.

Forest (with six formations) ; and Swamp Forest (with eight formations). Marsh Forest is seasonal swamp, with marked seasonal fluctuations in the moisture conditions of the habitat from water-logged to very dry. With this definition it is possible to include within this formation-series the Savanna—a classification that may seem somewhat strange. Swamp Forest, in contrast, implies inundation or water-logged conditions where the soil rarely has a chance to dry out completely for any appreciable length of time.

The vegetation of the regions is dealt with under the headings : Coastal Region, Lowland Region, Pakaraima Montane Region, and Southern Upland Region. Under the formations there are described numerous communities, associations, assemblages, consociations, faciations, facies, and lociations.

There are twenty one figures, including seven profiles of types of forest as black and white text figures, four maps, and photographs of various plant communities. There is a list of bibliographical references but no index.

W. B. Turrill.

Plant Diseases.*—So rapid has been the progress of plant pathology in the last quarter of a century that the first edition of this book, published in 1928 had become obsolete. The new edition has been completely re-written with the incorporation of the more important data available by the end of 1951. Hence it is considerably larger than its predecessor and must be considered very good value in regard to current costs of printing.

In spite of its title this is a manual of plant pathogens, rather than a text book of plant diseases, and as such it forms an indispensable work of reference for plant pathologists in all parts of the world. The fungi are arranged in the conventional system and the reduction of numerous smut species to synonymy advocated by Fischer and followed by Ainsworth and Sampson has not been adopted. It is gratifying to find that the numerous " genera " distinguished from *Sclerotinia* by conidial states alone are also rejected. *Phialea* is still retained in the sense of Boudier as opposed to that of von Höhnel, Nannfeldt and others. The name *Sclerotinia fuckeliana* has been adopted to replace *Botrytis cinerea* and related species of *Botrytis* are described among those of *Sclerotinia* even though their apothecia are still unknown.

Several important changes in the names of plant pathogenic fungi have been made even since 1951. Some of these may be matters of opinion and Prof. Brooks might well not have adopted them, examples are *Crinipellis perniciosa* (Stahel) Singer, *Mycena citricolor* (Berk. et Curt.) Sacc. and *Ascochyta sorghi* Sacc. to replace *Marasmius perniciosus* Stahel, *Omphalia flavida* Maubl. and Rangel and *Ascochyta graminicola* Sacc. respectively. The replacement of " *Dasyscypha calycina* Fuckel " by some combination based on *Lachnella hahniana* Seaver appears, however, to be inevitable.

R. W. G. Dennis.

*Plant Diseases. F. T. Brooks. XIV + 457 pp. Oxford University Press 1953, £1 18s. 0d.

VARIATIONS IN REED STRUCTURE IN RELATION TO THATCHING.

(A report on an investigation made at the request of the Rural Industries Bureau).

By Margaret Y. Stant.

It has for long been known that the Norfolk reed (*Phragmites communis* Trin.) has a high reputation for thatching purposes. There is also a rural tradition that reeds of the same species from other parts of the country are less satisfactory for this purpose. In order to ascertain whether these alleged differences can be correlated with the anatomical structure of the reeds, a special investigation was undertaken at the request of the Rural Industries Bureau, who forwarded samples of reed to Kew, for examination at the Jodrell Laboratory. Reeds were received from the following localities : Larling (Norfolk), Catfield (Norfolk), Weeley (Essex), Romney Marsh (Kent), Christchurch (Hampshire), Lymington (Hampshire), Totton Causeway (Hampshire), Fishguard (Pembrokeshire) and the Cherwell Valley (Oxfordshire). These places are widely scattered round the east and south coasts of Britain and include one inland type.

In order to study the internal structure of the stems, transverse sections were taken from the internodes at different levels and stained and unstained preparations examined. These revealed quite conclusively that there are definite structural differences between reeds of this one species grown in different parts of the country.

General Anatomy of the Stem.

Transverse sections of the reed *Phragmites communis* show a type of structure which is common in many grasses. The vascular bundles run vertically through the internodes of the hollow stem, and in sectional view, are arranged in three or four rings scattered irregularly in a ground tissue of thin walled parenchyma. The bundles show an even gradation in size, the largest ones being towards the centre. A variable amount of sclerenchyma is also present. This tissue consists largely of fibres with thick lignified cell walls. There is commonly a band of fibres beneath the epidermis, and the individual vascular bundles are surrounded by groups of fibres. Special attention has been directed to examining the amount and arrangement of this fibrous tissue, since the mechanical properties of the canes may well be correlated with its amount and distribution.

Each vascular bundle shows a characteristic structure. There is one large metaxylem vessel on each side (occasionally a radial pair), and between these and towards the centre of the stem, a small group of two or three protoxylem vessels, which in older parts of the stem break down to form a continuous canal running longitudinally. The phloem tissue may also disintegrate to form a vertical cavity.

Air Cavities.

Near the surface of the stem there is a single layer of large parenchyma cells, linking the vascular bundles in the outermost ring. Between this layer of cells and the epidermis is a cortical zone composed mainly of

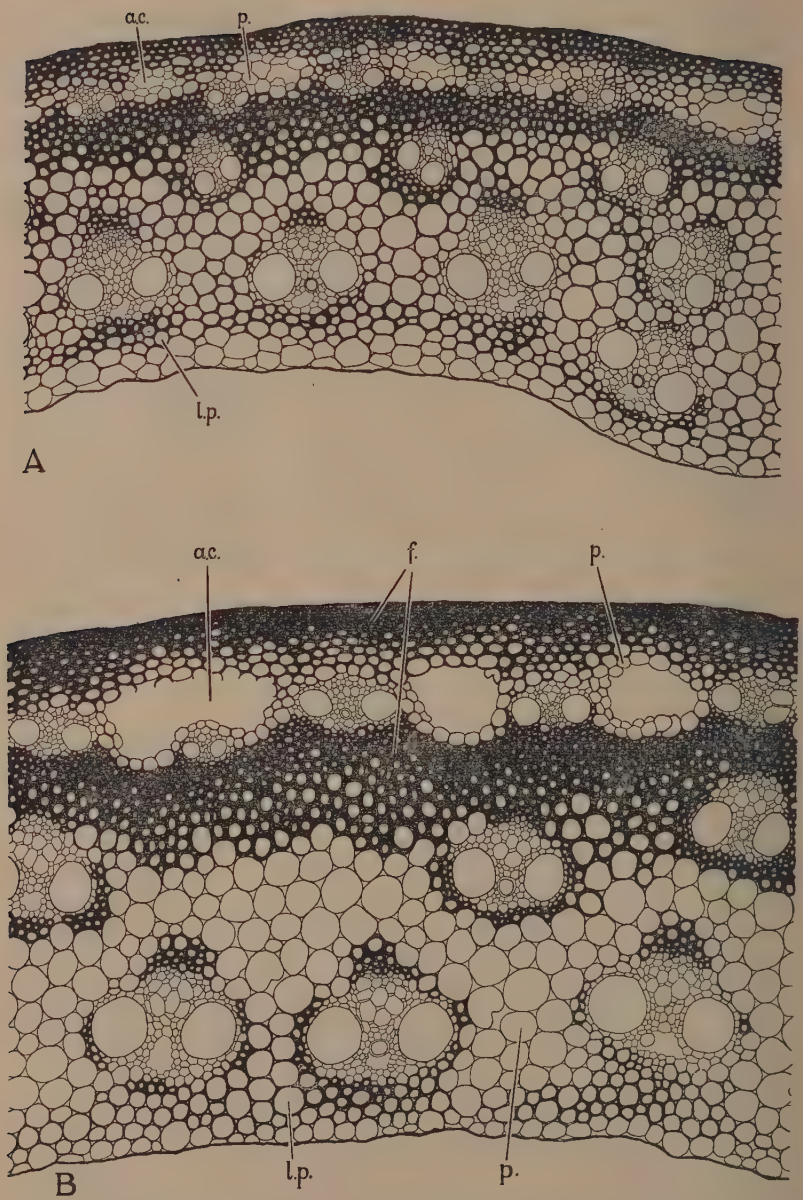
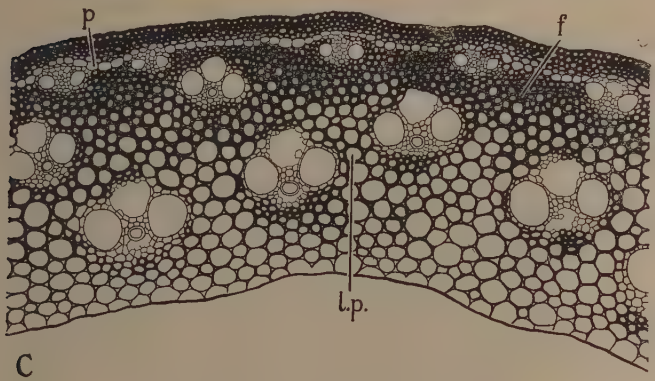


Fig. 1. *Phragmites communis* Trin. Transverse sections of stems.
A. Reed from Lymington showing 2 outer zones of fibrous tissue separated by parencyhma. The inner ground tissue consists of parenchyma, some lignified. Cortical zone of parenchyma shows early stages in the formation of air cavities.
B. Soft reed from Totton Causeway. 2 distinct concentric bands of fibres contrast with the inner ground tissue of thin-walled parenchyma. Large air cavities in the parenchymatous cortical region.
Lignified cell walls solid black.
a.c. air cavity, f. fibres, l.p. lignified parenchyma, p. parenchyma. × 100.



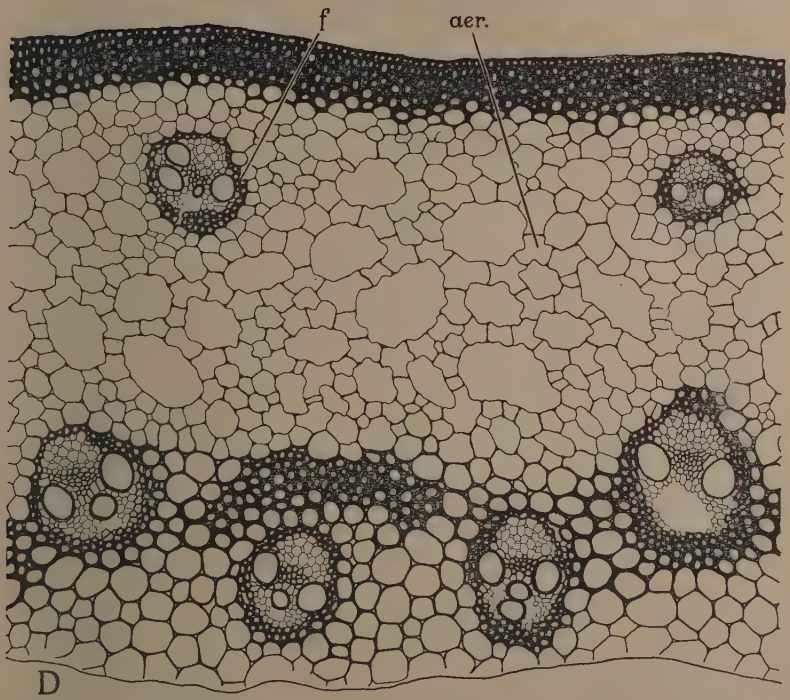


FIG. 2. *Phragmites communis* Trin. Transverse sections of stems.
C. Hard Norfolk reed from Larling showing homogeneous lignification of the ground tissue broken only by a single layer of cortical parenchyma. An outer zone of fibres passes gradually into thick-walled lignified parenchyma. D. Light spongy reed from the Cherwell Valley. A peripheral zone of fibres. Most of the ground tissue occupied by a thin-walled aerenchyma with large air spaces. Other fibrous tissue and lignified parenchyma associated with the vascular bundles. Lignified cell walls solid black.
aer. aerenchyma, f. fibres, l.p. lignified parenchyma, p. parenchyma. × 100.

parenchyma cells, many of which are lignified, together with some fibres. In this region the parenchyma cells may break down to form cavities, outside and between the peripheral vascular bundles. The disintegration is extensive in the Christchurch and Totton Causeway reeds, and in some places, adjacent cavities coalesce outside the bundles (Fig. 1B) to form larger intercellular spaces, which may extend for some distance round the stem. The cavities are not so well developed in reeds from Lymington (Fig. 1A), but are indicated by smaller areas in which incipient breakdown of the tissues can be seen. Cavities do not occur in the other reeds examined, with the exception of occasional ones found in the Weeley sample, in which the disintegration of only 2—4 cells is involved. In those reeds in which cavities are not present, the cortical region of the stem consists almost entirely of lignified tissue. It appears that the cavities are only formed where there is a cortical zone of thin-walled parenchyma, with patches of larger cells in which the breakdown is initiated.

In all the reeds examined, the cavities are present only in the more basal internodes of the stem. Their presence renders the stem less rigid and might be expected to lower its resistance to decay, by the provision of suitable space for fungal proliferation. Where the cavities extend for some distance tangentially, they eventually cause an outer layer to split off from the inner core of the stem.

Reeds from the Cherwell Valley show a different type of structure (Fig. 2D). There is a peripheral band of fibres immediately below the epidermis, and within this, a cortical zone of aerenchyma, in which the outer bundles are scattered. All the ground tissue of this zone consists of irregular, thin-walled parenchyma cells, the projecting arms of which enclose intercellular spaces. This conformation is commonly found in aquatic plants and suggests that these reeds are probably growing in a considerable depth of water. There is an inner ring of vascular bundles embedded in fibres and lignified parenchyma.

Distribution of Lignified Tissue.

In the Norfolk reeds from Larling and Catfield (Fig. 2C), the lignified tissue, in transverse section appears to be homogeneous. Sections stained in safranin or phloroglucin (lignin stains) show a regular decrease in intensity of colour towards the centre of the stem, accompanied by a gradual increase in cell size. Detailed examination shows that beneath the epidermis there is a zone of thick-walled fibres which extends towards the centre and includes the two outer rings of vascular bundles. It is broken only by the single curving layer of larger parenchyma cells, the walls of which are slightly lignified and thickened. The cells of the fibrous zone become larger and thinner walled towards the centre of the stem and pass gradually into thick-walled lignified parenchyma, which constitutes all the ground tissue between the bundles, apart from groups of fibres associated with the vascular strands. The parenchyma shows a similar decrease in wall thickness and increase in cell size centripetally.

Reeds from the south coast, e.g. Totton Causeway (Fig. 1B), and Christchurch, show a definite concentric zonation of tissues with an alternation of hard and soft bands. There is a zone of fibres beneath the epidermis which is separated from another band of fibres by the paren-

chymatous cortex in which the air cavities occur. The inner zone of fibres is bounded externally by a sinuous chain of large, thin-walled, parenchyma cells, which links up the vascular bundles of the peripheral ring. The fibres extend inwards to include the second ring of bundles. At this point there is an abrupt transition to large, thin-walled unlignified parenchyma cells, which occupy all the ground tissue between the large central vascular strands. In some reeds, e.g. those from Totton Causeway, there is a narrow zone of slightly lignified parenchyma immediately bounding the hollow pith. Reeds from Fishguard, Weeley and Lymington (Fig. 1A) show a less pronounced concentric zonation. The arrangement of tissues in reeds from the Cherwell Valley has been described in the previous section.

There is a striking and fundamental difference in appearance between transverse sections of reeds from south coastal areas and those from Norfolk. The latter have a compact and uniform tissue structure with a barely perceptible transition from sclerenchyma to lignified parenchyma. In reeds from the south coast, the lignified tissue is present in concentric bands separated by soft spongy parenchyma. The two tissues have different physical and chemical properties, and one would expect them to react in different ways to external influences, such as variations in humidity of the atmosphere. The stresses set up may easily result in concentric splitting of the stem, so that it peels in layers. In these reeds, also, the inner and greater part of the ground tissue is parenchymatous, and there is a lower proportion of lignified tissue. This, in itself, constitutes a mechanical weakness. The more complete lignification of the Norfolk reeds, with the strongest tissue concentrated at the periphery, gives rigidity to these stems and renders them more resistant to decay.

Fibre Length.

It was thought that there might be differences in the length of the fibres of reeds from various localities. In order to test this possibility, reeds were selected from five of the areas, and the lengths of a large number of individual fibre cells were measured. It is generally recognized that the strength of fibrous tissue is related to the length of the individual cells of which it is composed. The fibre cells are comparatively short when initiated, but during the growth of the stem, they increase in length, the ends of the cells penetrating between those that were previously adjacent. This mode of elongation is usually referred to as " sliding-growth ". It will be readily understood that sliding growth results in a closely knit mass of cells, in which the pointed ends of the cells become interlaced. Short fibres will be less intimately bound to their neighbours than those that are long, so that a tissue of short fibres will be more likely to crack and splinter.

It was first ascertained that fibre length and internode length show a parallel variation, so that by measuring fibres from the longest internode of each of the stems to be tested, comparable results should be obtained. 10 reeds were then selected from each sample, and a portion of stem from the middle of the longest internode of each was removed and macerated by the following method.

Small pieces of stem tissue were boiled in 50 per cent. potassium hydroxide solution, until soft. After washing in water, the fibres were

mounted in dilute glycerine and teased apart under the binocular microscope. 4 preparations were made from each cane, and from each of these 25 fibre cells were chosen at random and measured, using a projection apparatus at a magnification of × 66. Each result given in the table is therefore the mean of 1000 measurements.

Location	*F. Fibre Length mm.* (mean of 1000)	*I. Internode Length mm.* (mean of 10)	*F*/I × 10–3
Larling, Norfolk ...	1·092	123·4	8·85
Fishguard ...	0·993	158·5	6·66
Weeley, Essex ...	1·126	180·8	6·23
Lymington ...	0·775	161·8	4·79
Totton Causeway ...	0·845	235·0	3·59

The table also shows the mean length of the longest internode.

The results show that the Norfolk type of reed has longer fibres and shorter internodes than other reeds. The effectiveness of the fibre length will presumably be modified to some extent by the internode length. Calculation of the ratio $\frac{\text{fibre length}}{\text{internode length}}$ clearly shows the greater strength of the Norfolk reeds in this respect.

Summary and Discussion

That the reeds from Norfolk and other parts of the country differ externally in such properties as, bulk and firmness is apparent to the naked eye. Study of the internal structure confirms that these differences are the outward manifestation of anatomical variations. The reeds can be divided into two categories : (1) those from Norfolk with more lignification, thicker cell walls, no air cavities and longer fibres. (2) those from the south coastal regions with less lignification, a considerable amount of large celled parenchyma alternating with the fibrous tissue, the development of air cavities and shorter fibres. Reeds from Fishguard, Weeley and Romney Marsh represent an intermediate type. The Essex reeds are nearer in structure to the Norfolk reeds except for the presence of small air cavities in the Weeley sample, but the Fishguard reeds more closely resemble the south coastal type. Reeds from the Cherwell Valley with cortical aerenchyma are perhaps the softest and least durable.

All these factors would account for the greater durability of the Norfolk reeds. Their more extensive lignification together with the absence of air cavities would give these reeds greater resistance to decay (to fungal infection and other disease). Differences of this nature would affect the lasting qualities of the stems and their suitability for use in thatching.

It is interesting to speculate upon the causes of these differences ; whether they are due to " nature or nurture " ? Since all the reeds belong to the one species *Phragmites communis* Trin., the different types may have evolved as local races or varieties, which have become genetically fixed, or the differences may be due to environmental factors. In this connection, mention should be made of the work of Tobler (1943) who attempted to establish that the mechanical properties of reeds are intimately related to such factors as the calcareous nature of the soil and its

nitrogen content, and the water level. The nitrogen content of the soil affects the metabolic balance within the plant cells thus determining the relative proportions of protein and carbohydrate materials synthesised. A high carbon/nitrogen ratio leads to the production of cell wall material and a hard structure. A low carbon/nitrogen ratio favours the formation of protoplasm and a soft watery tissue. The concentration of the elements calcium and sodium in the soil and its hydrogen ion concentration are also causal factors in cell differentiation and extension.

To test these various possibilities it would be necessary to conduct a series of transplant experiments. If reeds from Norfolk grown in the south coastal areas showed no reversion to the soft stem structure 'native' to that region, the hereditary origin of the differences would be confirmed. (A cytological examination of the reeds from the different areas might also provide some evidence of whether or not the differences are hereditary). But if there were any adaptation to the new soil conditions, it would be necessary, in the first place, to determine the chemical and physical differences between the soils and soil water from the various localities, and secondly, to test the effect of each of these factors separately.

Reference

Tobler, F. 1943 : Stengelbau, Festigkeits-und Verwertungsunterschiede beim Schilfrohr (*Phragmites communis* Trin.) Angewandte Botanik *25*, 165–177.

Addendum.

Harvesting Effects.

After this work was completed we received from the Rural Industries Bureau, two further samples of reed for comparison. One of these was from an area where the reed beds are harvested regularly, and the other was from an adjacent locality where the reeds are growing wild and have not been previously cut.

The reeds from the unharvested area are larger in diameter and less rigid to the touch. Examination of sections from this material showed that the fibres are mainly confined to two bands, one peripheral, and the other immediately within the cortical zone in which air cavities occur. All the inner ground tissue is composed of thin-walled parenchyma cells. This structure approximates fairly closely to the type found among reeds from the south coastal regions, described above. In contrast, stems from nearby reed beds which have been cut regularly, showed the more uniform distribution of lignified tissue, which has been described as normal for the Norfolk reeds used in thatching.

This suggests that regular cutting of reed beds may induce some improvement in the strength of the reeds. This is manifested by an increase in the lignification and a more uniform distribution of this hard tissue. In the light of this new information, further inquiry was made, in order to ascertain the exact nature of the original nine samples of reed. The Rural Industries Bureau then disclosed that only the samples from Norfolk were obtained from reed beds subjected to regular harvesting. It is possible that their superior quality may to some extent be the result of periodic cutting, and this hypothesis offers some hope for improving

the strength of the reed from those beds in south coastal areas, which the Rural Industries Bureau wishes to utilise and develop.

It is evident that regular harvesting effects changes in the stem structure of *Phragmites communis*. This may be an important factor in the variations observed between reeds from different localities. The matter may however be further complicated by hereditary and soil factors. In this connection it is perhaps significant that the most 'abnormal' histology is observed in the Cherwell Valley reeds growing in fresh water. In the other areas the water is distinctly brackish and at Totton and Christchurch the sea water floods the region at certain periods. With the anatomical examination completed it is possible to indicate the other problems involved, but considerable experimental work would be necessary to estimate the separate effects of biotic, edaphic and genetic factors.

Guatemalan Orchids.*—Once again we are indebted to Dr. D. S. Correll for an excellent account of the orchids of a part of the American continent. Dr. Correll's book on the orchids of North America is now followed by the present work, started in conjunction with the late Professor Oakes Ames, but carried out in the main part by Dr. Correll himself.

A really detailed orchid Flora of even a part of Central America is long overdue since it is difficult to find one's way about in the very rich orchid population of this region. The accounts previously published (the *Flora of Costa Rica* and even the recent *Orchidaceae of Mexico*) both lack the thorough descriptions and complete citation of specimens which make the present book so valuable. Together with the generic and specific keys and the really delightful line drawings (107 in the first half of the book) by a band of gifted botanical artists, these provide almost everything that the serious student can desire. It is unfortunate, however, in view of the deliberately artificial keys used for the identification of the species, that these latter have been arranged in alphabetical order in each genus, since allied species may be widely separated both in the key and in the text. This may cause difficulties during the study of the plants of an area where, as Dr. Correll himself observes, many additional and perhaps unknown species are to be expected on further botanical exploration.

The first part deals with all the genera up to *Epidendrum* in Schlechter's system of classification of the family. We shall look forward eagerly to the appearance of the second part which is promised this year.

V. S. SUMMERHAYES.

*Orchids of Guatemala by Oakes Ames and Donovan Stewart Correll [Part 1]. Fieldiana, Botany, Vol. 26, No. 1, pp. xiii + 395, 107 figures in the text. Chicago Natural History Museum, 1952. Paper $4, buckram $5.

FISH POISONS OF BRITISH GUIANA.

D. B. Fanshawe.

The Amerindian tribes of South America have from time immemorial used the extract from certain indigenous and introduced plants to poison fish. A few of these plants have a lethal or semi-lethal effect, and most of the introduced species cultivated by the Amerindians are in this category. The majority have a narcotic or stupefying effect.

Poisoning of fish is still practiced in British Guiana today by the Amerindians, despite the fact that district administrators are trying to stamp out the practice for being illegal. On occasion the practice leads to friction with other sections of the community, as when cattle and horses die from drinking at poisoned pools on the Rupununi savannas.

Some eight different plants are commonly used to poison fish, three of them introduced, the rest indigenous. A further twenty plants, nearly all indigenous, are used occasionally when they happen to be handy or the more popular ones cannot be obtained. Another twenty indigenous plants are used as fish poisons in other parts of South America but are not so used in British Guiana.

Four methods of introducing the poison into the water are commonly used, depending on the type of plant and what part contains the toxin.

(1) Where the toxin is in the bark and wood of trees. The bark and wood are chopped up into small pieces and the chips thrown into the water. The toxin leaches out slowly or quickly into the water and kills or stupefies the fish. *Talisia furfuracea* and *T. squarrosa* (possibly other species of *Talisia*) are the only strongly toxic commonly used fish poisons of this class and they have a lethal effect. *T. furfuracea* is more toxic than *T. squarrosa*. Other plants occasionally used are *Alexa* spp., *Clathrotropis* spp., *Mora excelsa*, *Tapura guianensis* and *Cusparia fanshawei*, all weak narcotics.

(2) Where the toxin is in the bark or roots of shrubs and climbers. The stems or roots are macerated or bruised on a log or stone at the water's edge and the sap is allowed to run into the water. The toxin in the sap kills or stupefies the fish. In the case of the popular *Lonchocarpus martynii* and *Tephrosia toxicaria* the roots are used ; in the case of *Serjania paucidentata*, which is commonly used and the only lethal species, and *Lonchocarpus chrysophyllus*, *L. rariflorus*, *Derris pterocarpus*, *Bowdichia virgilioides*, *Byrsonima crassifolia* and *Bauhinia* spp., the stems are used.

A variation on the above method is employed for the introduced *Euphorbia cotinoides* because the juice is liable to blister the skin and cause temporary blindness if it enters the eyes. The leafy branches of this shrub are placed in an old, covered-in basket and immersed in shallow water where basket and contents are pounded until the juice runs into the water. The milky juice is toxic.

(3) Where the toxin is mostly in the leaves, rarely in the bark, fruit or suckers of trees, shrubs or herbs. The leaves, bark, fruit or suckers in question are placed in a trough in the ground shaped like a mortar and pounded with a pestle into a pulpy mass. This pulpy mass is placed in a covered-in basket and immersed in the water. The toxic pulp and juice

run into the water and stupefy or part kill the fish. The only one of this group commonly used is *Clibadium* spp. (leaves) which is semi-lethal in that some fish will recover from the effects of the poison while others die. Other plants occasionally used are *Phyllanthus acuminatus* and *P. brasiliensis* (leaves) semi-lethal, and *Antonia ovata* (leaves), *Conomorpha magnoliifolia* (bark), the introduced *Agave americana* (suckers) and Kowar (fruit), an unidentified riparian tree of the far interior, all of which are narcotic.

(4) In special cases the toxin is introduced into bread, flour or even cotton, made up into little balls and thrown into the water as bait for fish. Besides the bread or flour, pork or crushed caterpillars are introduced to make the balls tasty to the fish, and burnt cork or arrow cane for magic. The latter is a superstition that the addition of the charred remains of a plant or object which floats of itself will make the bait float. *Clibadium* spp. pulped as above (3) are commonly used. If they are unobtainable, *Pothomorphe peltata* or *Piper* sp. are occasionally used. Only certain kinds of fish will take this form of bait.

Fish poisons are strictly divided as regards speed of reaction and place of employment on the basis of killers and stupefiers. The lethal fish poisons are slow to act, require 8–24 hours and presumably on account of this are only used in pools or very slow running water. Fast running water would dissipate the poison before it had time to act. The narcotic fish poisons act fast, within 15–30 minutes, and can be used in fast running water. Naturally, they are also used in slow running or still water. The amount of any plant used depends chiefly upon the type of poison and the strength of flow or volume of water to be poisoned. If only a little poison is available, method (4) above is probably practiced as it is the most economical in poison. Obviously, much more poison needs to be used in fast than in slow running water, in slow running than in still water.

Euphorbia cotinoides is the most toxic of the lethal fish poisons, so much so that the fish are almost spoiled. Not only are they dead but they have usually begun to putrify before being removed from the water. *Clibadium* spp. are the most toxic of the semi-lethal poisons. *Lonchocarpus martynii* and *L. chrysophyllus* are the most toxic of the narcotic group. *Clibadium* and *Tephrosia* act faster than any other poison. Curiously, *Clibadium* will not act in brackish water but *Lonchocarpus* and *Tephrosia* will do so. Incidentally, the quickest and most effective method of obtaining live fish bait is by employing a narcotic fish poison and allowing the fish to revive in fresh water. Only one fish has any real resistance to fish poisons and that is the Yarau (*Erythrinus erythrinus*). Even *Euphorbia* scarcely affects this fish.

NEW MALAYSIAN SPECIES OF PENTAPHRAGMA.

H. K. Airy Shaw.

In the course of revising the *Pentaphragmataceae* for the *Flora Malesiana*, the following new species were detected.

Pentaphragma lanuginosum *Airy Shaw*, sp. nov., a *P. grandifloro* Kurz (*P. macrophyllo* Oliv., *P. philippinensi* Merr.) caule petiolis nervis subtus et hypanthio valde crispulo-lanuginosis praecipue differt.

Statura ignota (caulium apicibus tantum asservatis). *Caulis* robustus, superne 7–12 mm. crassus, lanuginosus. *Folia* oblique elliptico-obovata, 25–35 × 12–17 cm., basi cuneata, apice rotundata usque subacuta, plerumque brevissime apiculato-acuminata, margine denticulato saepe revoluto, siccitate membranacea, supra glabra, subtus breviter hispidulo-pubescentia, secus costam nervosque ± conspicue crispulo-lanuginosa ; nervi circiter 6-jugi ; petiolus robustus, 3–5·5 cm. longus, 4–8 mm. crassus, valde crispulo-lanuginosus. *Inflorescentiae* singulae ex axillis 1–2 superioribus ortae, primum subscorpioïdeae, mox elongati et laxi, 10–12 cm. longi, 10–20-florae, pedunculo 1·5–2 cm. longo lanuginoso, rhachi usque 7 cm. longa lanuginosa, bracteis late ovatis usque oblongis acutis 10–15 × 3–10 mm. membranaceis dorso puberulis. *Flores* magni, usque 6–7 cm. longi. *Hypanthium* elongatum, angustissime obconicum, sursum pergradatim ampliatum, 4–5 cm. × 3–5 mm., crispulo-floccosum. *Sepala* anguste vel late ovata, 13–17 × 4–12 mm., acuta, membranacea, dorso parce crispulo-floccosa, ceterum glabra. *Corolla* ut videtur choripetala, vel brevissime tantum gamopetala, carnosa, extra ± crispulo-flocculosa ; segmenta oblongo-elliptica, circiter 12 × 5 mm., subacuta, marginibus inflexis. *Filamenta* ± 2 mm. longa, antheris linearibus ± 3 mm. longis acutis. *Stylus* crassus, 2–3 mm. longus, stigmate cylindrico 5-costato 3 × 1·5 mm. *Fructus* ignotus.

Sula Is. (E. of Celebes). Taliaboe : Gunong Bapengkaja, 1913–14, *Atje* (*Hulstijn Exped.*) 260 (Herb. Bogor.).

Very close to *P. grandiflorum* Kurz (*P. philippinense* Merr.), but differing in the strongly developed shaggy indumentum of stem, petioles, midrib and inflorescence. *P. platyphyllum* Merr., which is rather strongly hirsute on the young parts and inflorescence, differs in its glabrous stem (when mature), cordate-based leaves, and sepals up to 2·5 cm. long.

Pentaphragma insigne *Airy Shaw*, sp. nov., *P. aurantiaco* Stapf affinis, a quo foliorum basibus inter se 2–3 cm. tantum distantibus secus caulem conspicue fere alato-decurrentibus, hypanthio anguste elongato-fusiformi praecipue differt.

Statura ignota, caulium parte superiore tantum suppetente, sed verosimiliter circiter 60 cm. alta ; *caules* robusti, 6–12 mm. crassi, fistulosi, glabri, nitidi, siccitate fusco-rubri, petiolorum basibus longe imbricato-decurrentibus insigniter costato-alati, alis 1–2 mm. latis. *Folia* late ovata usque late elliptica, leviter obliqua, 17–22 × 8–11·5 cm., basi subrotundata usque late cuneata, apice late acuta in cuspidem vel acumen breve acutum desinentia, margine pro rata grosse crenato-dentata dentibus 4–8 mm. inter se distantibus, siccitate firme papyracea, supra

glabra, subtus crebre breviter hispidulo-pubescentia ; nervi primarii 3–5-jugi ; petiolus (parte libera) 1·5–2·5 cm. tantum longus, 3–4 mm. crassus, fere glaber. *Inflorescentiae* singulae ex axillis 3–4 mediis vel superioribus ortae, plerumque triflorae, erectae, pedunculo 3–4 mm. longo dense crispulo-pubescente, bracteis ovato-lanceolatis usque 18 × 7 mm. apice valde attenuatis acutis extra crispulo-pubescentibus intus glabris nitentibus, pedicellis 1–2 mm. longis. *Hypanthium* elongato-fusiforme vel fere cylindricum, circiter 1·5 cm. longum, 2–4 mm. crassum, longitudinaliter striatum, dense crispulo-pubescens. *Sepala* pro rata parva, subspatulato-ellipsoïdea, 8–10 × 2–3 mm., obtusa, dorso leviter papilloso-puberula, ceterum glabra, sinubus late rotundatis sejuncta. *Corolla* late cupularis, circiter 6 mm. longa, usque $\frac{1}{3}$ vel fere $\frac{1}{2}$ gamopetala, firme carnosula, segmentis ovato-deltoïdeis basi circiter 4 mm. latis apice acutis margine integro anguste pallide cartilagineo. *Filamenta* 3·5–4·5 mm. longa, antheris lanceolatis apice attenuatis acutis 3·5 mm. longis post dehiscentiam linearibus. *Stylus* crassus, 3 mm. longus, stigmate oblongo 3 × 1·5 mm. obscure 5-sulcato. *Fructus* ignotus.

Borneo. Sarawak (Second Division) : Gunong Tiang-ladgiù (-laju), on sandstone, alt. 450–900 m., May 1867, *Beccari* 5697 (Herb. Florent.).

It is unfortunate that the lower parts of the stems of this striking species were not preserved, so that it is now possible only to estimate the total height of the plant. Although certainly nearest to *P. aurantiacum* Stapf (*P. grande* Ridl.), it differs notably in the extraordinarily decurrent petiole-bases, which form a series of sharp ridges down the somewhat shining reddish stem, and in the narrow elongate hypanthium.

Gunong Tiang-ladgiù lies south of Engkilili, on the Batang Lupar, in approximately long. 111° 39′ E., lat. 1° 4′ N.

Pentaphragma cyrtandriforme *Airy Shaw*, sp. nov., caule saepe abbreviato ut videtur subprostrato, foliis saepe creberrime sinuato-denticulato-crenulatis textura firmiore subtomentellis supra siccitate plerumque griseo-viridibus petiolis interdum elongatis, inflorescentiis densis capitatis vix scorpioïdeis 6–10-floris, bracteis firme papyraceis, floribus inter majores sepalis amplis corolla alte gamopetala distinctum.

Caulis 10–20 cm. longus, ± prostratus, superne tomentellus. *Folia* late elliptica usque elliptico-ovata, leviter obliqua vel fere symmetrica, 8–25 × 5–13 cm., basi cuneata usque rotundata vel raro leviter truncato-cordata, apice rotundata vel subacuta, margine creberrime sinuato-denticulato-crenulata (saepe conspicue, sed interdum obscure), supra glabra, subtus densiuscule furfuracea (sed interdum praeter nervos glabrescentia), siccitate coriaceo-carnosa, supra plerumque griseo-olivacea, subtus pallide ochracea ; nervi secundarii 3–7-jugi, parum curvati, marginem versus frequenter anastomosantes ; petiolus plerumque elongatus, 2·5–13 cm. longus, 2–5 mm. crassus, furfuraceus. *Inflorescentiae* singulae vel binae ex axillis superioribus ortae, capitatae, vix vel obscure scorpioïdeae, 1·5–4 cm. diametro, 6–10-florae, pedunculo usque 1 cm. longo furfuraceo, bracteis late ellipticis firme papyraceis vel herbaceis rarius submembranaceis dorso parce stellato-puberulis infimis 10–18 mm. longis 6–7 (–12) mm. latis acutis superioribus minoribus. *Flores* majusculi, 1–2 cm. longi, vel interdum hypanthio elongato usque

3 cm. longi. *Hypanthium* obovoïdeum, 8–10 mm. longum, 2–3 mm. crassum, furfuraceum, interdum (forma vix specifice separanda) anguste fusiforme, usque 2 cm. longum, 3–4 mm. crassum, angulatum, puberulum. *Sepala* elliptica, valde inaequalia, 8–13 mm. longa, 3–6 mm. lata, subacuta, interdum ciliolata. *Corolla* alte (4–7 mm.) gamopetala, usque 10 mm. longa, tubo urceolato-campanulato, lobis revolutis 2·5–3 mm. latis interdum dorso linea mediana puberulis intus ima basi breviter barbatis ceterum glabris. *Stamina* inclusa, 4 mm. longa, anthera subulata. *Stylus* crassus, stigmate pentagono-cylindrico 2–3 mm. longo 1 mm. crasso. *Fructus* ellipsoïdeus, usque 1·5 cm. longus et 7 mm. crassus.

Malay Peninsula. Pahang : Gunong Tapis, Kuantan, in damp dark spots, *c.* 1380 m. alt., 14 June 1934, *Symington & Kiah* 28878 (typus, Herb. Kew.). Trengganu : Gunong Padang, sapling forest, 1200 m. alt., June 1937, *Moysey & Kiah* 31071 : " Small plant with flowers at base of leaf stalk. Flowers : 5 petals [sic !] white, 5 petals purple, shorter."

North Borneo. Mt. Kinabalu : Dallas, 900 m., forest, damp bank of bridle trail, 13 Aug. 1931, *J. & M. S. Clemens* 26071 : " Flower green-white." *Ibid.*, Dallas, in East Ravine, 750 m., wet bank of stream, 27 Nov. 1931, *Clemens* 27285 : " Flower cream." *Ibid.*, Colombon river basin, jungle gorge below Keebambang camp, side of hill, 1200 m., 21 July 1933, Clemens 34008 : " Flower white, green corolla." *Ibid.*, Colombon basin, gorge below Kebambang Lobang, 1350 m., 14 Aug. 1933, *Clemens* 34465 : " Flower white to greenish." Kinataki river, 1350 m., 14 March 1933, *Carr* (Singapore Field No.) 26584.

Sarawak. Gat, Upper Rejang river, forests at low altitude, 6 July 1929, *Clemens* 21663 : " Flower dull yellow, base cream." Mt. Poi, summit, 1800 m., drooping over great boulders in mossy forest, 25 Sept. 1929, *Clemens* 20264 : " Herb, 3 feet high, flower cream or white ; fruit green."

Indonesian Borneo. S. & E. Div. : Soengei Bloe-oe, 1896–7, *Jaheri* (*Exped. Nieuwenhuis*) 532. Oeloe Tjihan, 11 Dec. 1898, *Amdjah* (*Exp. Nieuwenhuis*) 338.—Probably this species : Boekit Batoe Tiban, 1700 m., Oct.–Dec. 1925, *Mjöberg* 58.

The range of variation in the material here referred to this species is considerable, particularly as to length of petiole and size of flower. It does not, however, seem practicable to divide it further. The short, subprostrate stem, the very densely sinuate-denticulate leaf-margin, the sometimes very long petiole, the capitate inflorescences with rather firmly papyraceous bracts, the rather large flowers with large sepals and gamopetalous corolla, appear to form a distinctive combination of characters.

Pentaphragma combretiflorum *Airy Shaw*, sp. nov.

Caulis e partibus superioribus tantum nota (unde statura ignota), ut videtur inferne robustus, usque 9 mm. crassus, laevis, glaber nisi partibus junioribus parce crispulo-pubescens, foliosus (in parte superiore folia 8–9 inter se 2–3 cm. tantum distantia gerens). *Folia* latissime elliptica vel obovato-elliptica, vix asymmetrica, 13–19 × 7–13·5 cm., basi cuneato-attenuata, rarius subrotundata, interdum leviter inaequilateralia, apice

rotundata brevissime latissime cuspidato-acuminata, margine brevissime undulato-denticulata, textura siccitate tenuiter papyracea, supra glabra, subtus brevissime et sparse papilloso-hispidula vel fere glabra, quintuplinervia vel rarius septuplinervia, petiolo 3–5·5 cm. longo gracili glabro. *Inflorescentiae* singulae vel binae ex axillis 4 superioribus ortae, breviter vel longiuscule scorpioïdeae, 1–3·5 cm. longae, 4 20-florae, floribus elongatis erectis valde regulariter parallele dispositis indolem *Combretorum* quorundam in mentem revocantibus ; pedunculus 7–8 mm. longus, crispulo-puberulus, bracteae pro rata parvae, ovatae, 5–7 × 3–5 mm., interdum bractea infima majore usque 12 mm. longa, membranaceae, ciliolatae, dorso puberulae ; pedicelli nulli. *Flores* 1·5–2 cm. longi. *Hypanthium* primo fere lineare, dein anguste fusiformi-lanceolatum, fere rostratum, 11–13 × 1–3 mm., ± pentagonum, striatum, parce puberulum. *Sepala* oblongo-obovata vel oblanceolata, 4–5 × 1–4 mm., rotundata, membranacea, dorso puberula. *Corolla* campanulata, ultra ½ gamopetala (serius alte fissa), 6 mm. longa, 5 mm. lata, extra parce vel densiuscule crispato-pubescens, segmentis oblongis vel ovatis erectis dorso subcarinatis apice acutis vel subacutis recurvis. *Filamenta* 2·5 mm. longa, antheris anguste lineari-lanceolatis 1·5 mm. longis acute apiculatis. *Stylus* circiter 2 mm. longus, stigmate oblongo pentagono 2 mm. longo fere 1 mm. crasso. *Fructus* maturus non visus, junior fusiformi-lanceolatus, 13 × 4 mm., seminibus fusco-castaneis ut videtur in placentis omnino immersis.

Natuna Islands. Great Natuna : Pulo Bunguran, Gunong Ranai, frequent in forest at 600 m., 19 May 1919, *Bünnemeijer* 5821 (typus, Herb. Bogor.) : "Flower cream-coloured." *Ibid.*, 15 April 1928, *van Steenis* 1390 (Herb. Bogor.).

A very distinct species in its leafy stem, almost symmetrical, regularly broadly elliptic leaves, and subscorpioid cymes of rather small cup-shaped flowers, with erect elongate hypanthia, arranged in parallel serried ranks, strongly suggesting the inflorescence of some *Combretum*. It is regrettable that the lower parts of the plants are missing.

Pentaphragma decurrens *Airy Shaw*, sp. nov.

Caulis 15–20 (–47) cm. altus, 4–6 (–10) mm. crassus, laevis, glaberrimus, lineis elevatis 4–5 e basibus petiolorum decurrentibus conspicue notatus. *Folia* late ovato-elliptica, leviter obliqua, 20–25 × 9–13 cm., basi cuneato-attenuata, apice angustato-acuta, interdum breviter subacuminata, margine obscurissime denticulata vel subintegra, crassiuscula, utrinque glaberrima ; nervi primarii laterales 4–5-jugi ; petiolus 1·5–2·5 cm. longus, 2–4 mm. crassus, dorso ut videtur acute carinatus, glaberrimus, conspicue decurrens. *Inflorescentia* ut videtur in caule solitaria, ex axilla superiore orta, vix scorpioïdea, 3–4 cm. longa, 10–12-flora, bracteis sepalisque ciliolatis exceptis glabra ; bracteae inferiores 12–14 × 4–7 mm., ellipticae, acuminatae, subintegrae vel parce ciliolatae, submembranaceae, superiores minores, magis eroso-ciliolatae ; pedunculus circiter 1·5 cm. longus ; pedicelli subnulli. *Hypanthium* breviter ellipsoïdeo-ovoïdeum, 5 × 2–3 mm., ± angulatum, glabrum. *Sepala* subspatulato-elliptica, 4–5 × 2–2·5 mm., parum inaequalia, apice rotundata, eroso-ciliolata, sinubus latis sejuncta. *Corolla* e floribus apertis mancis et alabastris tantum cognita, ut videtur fere choripetala ; segmenta elliptico-obovata,

3–4 × 1·5–2 mm., textura tenuiter petaloïdea, nullo modo carnosula vel cartilaginea, marginibus alabastro ± induplicato-valvatis, ut videtur cito caduca vel avulsa. *Stamina* ex alabastro tantum cognita : filamenta brevissima, antheris ovatis apiculatis 1–1·5 mm. longis. *Stylus* brevissimus, stigmate breviter pentagono-cylindrico circiter 1 mm. longo. *Fructus* breviter oblongus, 8× 4 mm.

Borneo. Sarawak : Mt. Matang, alt. 300 m., Aug. 1884, *Ridley* s.n. (Herb. Singapore) ; *ibid.*, 28 Aug. 1904, *Ridley* 12299 (typus, Herb. Kew.; dupl., B.M., Singap.) : " Pale green flowers. Leaves bullate." *Ibid.*, 4 Aug. 1912, *J. W. Anderson* s.n. (Herb. Singap.). Sarawak, sine loc. exact. vel dat., *Native Collector* (through Sarawak Museum for Bureau of Science, Manila) 1745. Kapit, Upper Rejang, 5 Sept. 1927, *Native Collector* 5253 (Herb. Calif.) : " Flowers white."

The only other known species with decurrent petioles is *P. insigne* A.S. (see p. 000, above), but this is widely different in other respects, being nearest to *P. aurantiacum* Stapf. The present species appears to be completely glabrous apart from the ciliate bracts and sepals. The corolla is very unusual in the genus in the thin petaloid texture of the almost free segments, the edges of which are induplicate in bud. Most of the open flowers on the material examined have lost their corolla-segments and stamens. It is very desirable to obtain better material of this interesting species.

Pentaphragma spatulisepalum *Airy Shaw*, sp. nov., foliis *P. acuminato* A.S. (vide infra) persimile, sed inflorescentiis laxis plurifloris (circiter 12-floris) bracteis elongate lineari-spatulatis pedicellis gracilibus 3–4 mm. longis sepalis oblanceolato-spatulatis distinctum.

Caulis 10–20 cm. longus, gracilis, glaber. *Folia* subfalcato-elliptica vel -ovata, 11–18 × 5–6·5 cm., basi cuneato-attenuata, apice attenuata, subacuminata, acuta, margine undulato-serrulata, textura tenerrima, ut videtur utraque pagina glaberrima, nervis primariis utrinque 2–4, petiolo gracillimo 1·3–2 cm. longo. *Inflorescentiae* singulae ex axillis 2–3 supremis ortae, 6–12-florae, laxiusculae, haud scorpioïdeae, 2–3 cm. diametro, rhachi usque 1·5 cm. longo, pedunculo 5 mm. longo minute ramentaceo-hispidulo. *Bracteae* lineari-spatulatae (infima elliptico-oblonga excepta), circiter 1 cm. longae, 1–2 mm. latae, basi in petiolum 2–3 mm. longum attenuatae, apice obtusae vel emarginatae, membranaceae, glabrae. *Pedicelli* graciles, 2–3 mm. longi, glabri. *Flores* 8–10 mm. longi, glabri. *Hypanthium* anguste ellipsoïdeum, 4–5 mm. longum, 1–2 mm. crassum. *Sepala* spatulato-oblonga, 5–6 mm. longa, 1·5–2 mm. lata, obtusa vel retusa, erecta vel leviter patula, quam in plerisque speciebus minus inaequalia. *Corolla* 4–5 mm. longa, ultra medium gamopetala, viridis, segmentis oblongo-ovatis 1·3 mm. latis obtusiusculis erectis apice recurvis. *Filamenta* circiter 2 mm. longae, antheris oblongis 1 mm. longis. *Stylus* 1·5 mm. longus, stigmate crasse pentagono-discoïdeo 1 mm. lato 0·8 mm. crasso quinquelobulato. *Fructus* ellipsoïdeus, 7–8 × 3–4 mm., basi attenuatus.

Borneo. Sarawak : Upper Baram River, 1920, *Moulton s.n.* (typus, Herb. Kew.) ; Dulit, primary forest (?), under 300 m., 19 Aug. 1932, *Native Collector* for *Richards* 1352 (Herb. Kew.) : " Sepals and petals green."

In foliage this species is almost identical with *P. acuminatum* A.S. (see p. 000, below), though the leaves of the latter are mostly somewhat thicker in texture. But the inflorescence is quite different. In *P. acuminatum* this is a short, compact, capitate structure, with a very short rhachis ; the upper bracts are small and inconspicuous ; and the sepals are relatively short and broad. In *P. spatulisepalum* the inflorescence is lax, with an elongate rhachis ; the upper bracts are elongate and conspicuous ; and the sepals are long and narrow.

By inadvertence the above *Richards* collection, and hence this new species, was omitted from the account of the *Pentaphragmataceae* of the Oxford University Expedition to Sarawak, published in *Bull. Misc. Inf.*, Kew, 1941, 233-6 (1042).

Pentaphragma tetrapetalum *Airy Shaw*, sp. nov., corollae plerumque tetramerae segmentis spatulatis fere unguiculatis ' limbis ' patentibus late ellipticis cartilagineo-marginatis integerrimis insigne.

Caulis circiter 10 cm. altus, cito sursum attenuatus, inferne glabrescens, apicem versus crispato-setulosus. *Folia* oblique late ovata, 13–19 × 8–11 cm., basi latiuscule cuneata, apice subrotundata in cuspidem brevissimam subacutam vel vix ullam angustata, obscurissime sinuato-crenulata, supra glabra, subtus secus nervos breviter pubescentia ; nervi 2–4-jugi ; petiolus gracilis, 2–3 cm. longus, ut videtur glabrescens. *Inflorescentiae* singulae vel binae ex axillis 1–2 superioribus ortae, breviter et dense scorpioïdeae, 2·5–3 cm. longae, circiter 12–14-florae, pedunculo 5–10 mm. longo, bracteis inferioribus late elliptico-ovatis circiter 8 mm. longis 6–8 mm. latis membranaceis pubescentibus, superioribus minoribus, pedicellis subnullis. *Hypanthium* ellipsoïdeum, 3 × 1·5 mm., pubescens. *Sepala* 5, obovata vel spatulato-obovata, circiter 5 mm. longa, 2–3 mm. lata, obtusa, membranacea, hispidula, ciliolata. *Corollae segmenta* 4, rarius 5, fere libera vel basi brevissime connata, unguiculato-spatulata, ' ungue ' erecto late oblongo 2 mm. longo, ' limbo ' ± patente vel recurvo subplano vel ± crispato-torto late elliptico 3 × 2·5 mm. subacuto margine integerrimo siccitate conspicue pallido velut cartilagineo-marginato. *Filamenta* gracilia, 1 mm. longa, antheris linearibus 2 mm. longis. *Stigma* sessile vel subsessile, crasse pileiforme vel subcerebriforme vel apice excavatum, 1 mm. crassum, fere 2 mm. diam. *Fructus* ellipsoïdeus, 8–10 × 3–4 mm., parce pubescens.

North Borneo. Batu Sima, Sandakan, along stream in forest, low altitude, 31 Oct. 1920, *Ramos* 1483 (field no. 413) (Arn. Arb.). Bettotan, near Sandakan, 19 Aug. 1927, *C. B. Kloss* 19159 (typus, Herb. Singapore ; dupl., Bogor, California, New York, Kew) : " Flowers greenish-white."

This differs from all other species known to me in the almost always tetramerous corolla (the calyx being pentamerous) and almost free unguiculate-spatulate petals with broadly elliptic, entire, spreading limb, which is conspicuously pale-margined in the dried state. In the gatherings so far known the stem is rather short, but this may be of no significance. The foliage is not distinctive.

Pentaphragma tenuiflorum *Airy Shaw*, sp. nov.

Caulis 15 cm. altus, 7 mm. crassus, ut videtur partibus junioribus exceptis glaber. *Folia* elliptico-ovata vel ovata, 9·5–16 × 7–10 cm., basi

truncato-rotundata vel subcordata, apice obtusa vel subrotundata, margine creberrime et tenuissime undulato-crenulata, crassiuscula, supra glabra, subtus dissite minute hispidula, nervis dense crispulo-puberulis ; nervi 3–4-jugi ; petiolus 4–6 cm. longus. *Inflorescentiae* ut videtur usque quaternatim ex axillis 3–4 superioribus ortae, circiter 4-florae, debiles, floribus elongatis ad apicem pedunculi congestis, pedunculo elongato 1·5–2 cm. longo, bractea ad medium pedunculum oblongo-elliptica 10–12 × 5 mm. breviter acuminata, bracteis sub floribus late ovato-ellipticis vel spatulato-ellipticis, 15 × 9 mm., 15 × 6–7 mm., 10–11 × 3 mm., acutis vel rotundatis dorso papillosis vel glabris margine ciliolatis. *Flores* ut videtur dioeci, masculi tantum noti, erecti (?), 2·5 cm. longi. *Hypanthium* elongatum, cylindricum, 1·6–1·9 cm. longum, 2–3 mm. crassum, brevissime parce pilosum. *Sepala* ovato-elliptica vel oblongo-elliptica, 8–9 × 3–5 mm., rotundata vel obtusa, minute parce ciliolata, ceterum glabra, membranacea, venosa. *Petala* libera, lingulata, 8–9 × 1·5–1·8 mm., obtusa, tenera ('petaloïdea'), ± induplicato-valvata. *Stamina* brevissima : filamenta 1–1·5 mm. longa ; antherae oblongae, leviter incurvae, crassae, 2 mm. longae. *Ovarii* et *styli* vestigia ut videtur nulla. *Flores* ♀ et fructus ignoti.

Borneo. Sarawak : Baram, May 1894, *Haviland & Hose* 3591 (Herb. Kew.).

In the dioecism of its flowers this species represents a unique type in the genus. The markedly delicate texture of the flowers, however, rendered their investigation difficult. The texture and arrangement of the petals in bud is apparently the same as that found in *P. decurrens* A.S., a species differing considerably in other respects. It is to be hoped that the female or hermaphrodite form of *P. tenuiflorum* will be collected in due course.

Pentaphragma Jaherii *Airy Shaw*, sp. nov., petalis tenuiter membranaceis liberis dorso crispulo-pilosis, habitu nano in genere distinctum.

Caulis nanus, 5 cm. longus, 3–4 mm. crassus, inferne parce superne densius crispulo-pubescens. *Folia* subfalcato-ovato-lanceolata, 7·5–9 × 3·5–4·5 cm., basi rotundata vel subcordata, sursum sensim in apicem subobtusum vel subacutum angustata, margine anguste revoluto ut videtur integro sed forsan re vera minutissime crenulato, crassiuscula, subtus distincte rotundato-papillosa, glabra nisi subtus secus nervos parce puberula ; nervi 3–5-jugi ; petiolus gracilis, 8–13 × 2 mm., puberulus. *Inflorescentiae* ut videtur pro caule singulae, ex axilla subterminali exortae, compactae, capitatae, vix manifeste scorpioïdeae, 2 cm. diametro ; pedunculus 1 cm. longus, pubescens ; bracteae pro rata magnae, late ovatae vel suborbiculares, usque 10 × 8 mm., membranaceae, crispulo-puberulae, margine laciniato-ciliatae vel fasciculato-pilosae ; pedicelli ± 1 mm. longi. *Flores* 9–12 mm. longi. *Hypanthium* campanulatum vel oblongo-ovoïdeum, 4–6 × 3–4 mm., puberulum. *Sepala* valde inaequalia : sepalum minimum oblongo-ellipticum, 4 × 1·5 mm. ; sepalum maximum suborbiculare, 4–5 mm. diametro ; cetera intermedia ; omnia membranacea, crispulo-puberula, valde eroso-ciliata. *Petala* libera (vel forsan ex annulo membranaceo exorta ?), elliptico-oblonga, 4 × 1·5 mm., tenuiter membranacea, marginibus inflexis, apice subcucullata, dorso crispulo-puberula. *Filamenta* 1·5 mm. longa ; antherae

lineares, 1 mm. longae. *Stylus* late conicus, 1 mm. longus, stigmate conico 1 mm. longo. *Fructus* ignotus.

Indonesian Borneo. S. & E. Division : Upper Mahakam River, Bukit Batu Ajoh, 1896–7, *Jaheri* (*Exped. Nieuwenhuis*) 1642 (Herb. Bogor.).

The available material consists of a single small plant, bearing a single inflorescence, and some hesitation was naturally felt in making it the type of a new species. Since, however, it falls into the small group with " petaloid " petals, and is perfectly distinct from the other two known species of the group (*P. decurrens* A.S. and *P. tenuiflorum* A.S.), it was felt that description was justified. It should be pointed out that, striking as the petal-character of these species is, it appears to be quite uncorrelated with other characters, and it would be unnatural to group these species together as a formal Section.

Pentaphragma acuminatum *Airy Shaw*, sp. nov., a *P. Horsfieldii* (Mig.) A.S. (vide infra) glabritie fere totius plantae, foliis apice attenuato-acuminatis brevius petiolatis, inflorescentiis parvis capitatis paucifloris praecipue differt.

Caulis 12–30 cm. longus, glaber vel partibus junioribus parce furfuraceo-puberulis. *Folia* inter minora, oblique ovata usque (saepius) ovato-lanceolata, 8–15 × 3–5 cm., basi decurrenti-cuneata, rarius subrotundata, apice sensim attenuato-acuminata, margine brevissime obtuse undulato-dentata et saepe revoluta, supra glaberrima, subtus glabra vel (praecipue secus nervos) parce minute puberula vel minutissime granuloso-papillosa, textura plerumque tenera ; nervi secundarii 2–3-jugi, parum curvati ; petiolus 1–2·5 cm. longus, gracilis, glaber vel parce furfuraceo-puberulus. *Inflorescentiae* singulae vel binae ex axillis 1–4 mediis vel superioribus (nec tamen supremis) ortae, parvae, capitatae, haud scorpioïdeae, circiter 1 cm. diametro, 2–10-florae, pedunculo circiter 5 mm. longo glabro, bracteis glabris infimis ovato-lanceolatis 7 mm. longis 3 mm. latis acutis superioribus cito decrescentibus. *Flores* circiter 1 cm. longi. *Hypanthium* 5–6 mm. longum, 3–4 mm. crassum, glabrum. *Sepala* circiter 3 mm. longa, usque 2 mm. lata, obtusa. *Petala* circiter 3 mm. longa, fere 2 mm. lata, obtusa vel leviter cucullata, reflexa. *Stamina* circiter 1·5 mm. longa, anthera oblonga. *Stylus* crassus, 1–1·5 mm. longus, 1 mm. crassus, stigmate crassissimo 1·25 mm. longo et crasso. *Fructus* ellipsoïdeus, 7–8 mm. longus, 4–5 mm. diametro, glaber.

Indonesian Borneo. S. & E. Division : W. Koetai, primary forest on narrow stony mountain ridge covered with humus, *c.* 1500 m. alt., 12 Oct. 1925, *Endert* 3937 (typus, Herb. Lugd.-Bat.) : " Flowers yellowish-green, edges of the corolla brownish-red."

Sarawak. Gat, Upper Rejang River, forests, 1929, *J. & M. S. Clemens* 21699 : " Undershrub. Fl. cream becoming dull red or pink."

North Borneo. Kalawat, 1856, *Lobb* (Herb. Kew.). Mt. Kinabalu, Kiau, 2 Nov. 1915, *M. S. Clemens* 10079 (Herb. Calif., Arn. Arb.) : " Fruit green " ; 10097 (Arn. Arb.) : " Fl. yellow ". Dallas, secondary forest, trails, and woodlet below rest-house, alt. 1500 m., not uncommon, 24 Aug. 1931, *J. & M. S. Clemens* 26030 : " Succulent herb, 1 ft. or less. Flower white. Fruit green."

This species is distinguished by the (usually) almost completely glabrous state of the whole plant, the gradually acuminate, shallowly sinuate-dentate leaves, and the small, few-flowered inflorescences.

Clemens 21699, from Gat, Sarawak, is represented in Herb. Kew. by two fruiting specimens, in Herb. Lugd.-Bat. by three flowering ones. The latter are distinctly furfuraceous-stellate-pubescent on the young parts, and there are traces of this on the fruiting specimens also. In other respects, however, this gathering agrees with the other collections cited above, and for the present I regard it as a form of this species.

It seems possible that the *mélange* of forms found in the southern part of the Malay Peninsula and the Lingga Archipelago, including *P. ellipticum* Poulsen, *P. Ridleyi* King et Gamble, and part of *P. Horsfieldii* (Mig.) A.S. (see below), may have arisen through hybridization between *P. acuminatum* and *P. Horsfieldii sensu stricto*. This group can, however, evidently be satisfactorily interpreted only by detailed study of the populations in the field.

Pentaphragma horsfieldii (*Miq.*) *Airy Shaw*, comb. nov.

Cyrtandra Horsfieldii Miq. *Fl. Ind. Bat.* **2,** 738 (1858).

Pentaphragma Scortechinii King et Gamble in *Journ. As. Soc. Bengal*, **74,** II, 55 (1905) (Mat. Fl. Mal. Penins., Gamopet., no. 16, 265).

In the account of the *Pentaphragmataceae* which has been prepared for the *Flora Malesiana*, it has been found necessary to bring together several supposedly distinct species related to *P. scortechinii* King et Gamble. The earliest name for the group appears to be provided by the plant described by Miquel as *Cyrtandra horsfieldii* Miq., stated to have been collected by Horsfield in the island of Banka. A Horsfield specimen, presumably representing this species, is preserved at the British Museum (Nat. Hist.) ; it agrees well with Miquel's description, though it is localised as from Sumatra.

The above new combination is therefore necessary. Fuller synonymy will be given in the *Flora*.

Tea, its pests and diseases*.—This book is intended to be a practical guide to the tea planter, to assist him to identify the pests and diseases which affect his crop, and to find out how best to prevent, minimise and control their activities. It is well produced, at a reasonable price, and should meet with a favourable reception from the community to which it is addressed. The text is planned throughout with an eye to easy consultations by an unscientific reader, with pests and diseases grouped according to the organs attacked, instead of in the ordered sequence of Zoological and Mycological taxonomy. Particularly useful features are the keys for identification of root diseases by their symptoms and to the causes of sudden death in tea bushes. Much space is devoted to these

*Tea Pests and Diseases and their Control with special reference to North East India by E. Hainsworth. Cambridge : W. Heffer & Sons Ltd. pp. XII + 130, 1952. 18/-.

troubles and special stress is laid on the importance of root control in the spread of infection from dead to living bushes.

In reading the book we feel from the outset that the author is a practical man with a realistic outlook and an understanding of the limitations of plantation management. Hence the control measures recommended have an authentic ring and have evidently been tested and found practicable with the labour available in north-east India. Stress is laid throughout on the prevention of serious outbreaks of diseases by appropriate cultural treatment rather than on control measures to be applied after the damage has been done. Interesting in this connection are the brief notes on action to be taken to prevent outbreaks of disease following the " Common Calamities, Drought, Earthquake, Hailstorms, Lightning, Fire and Erosion ".

The book is illustrated entirely by uncoloured photographs. Many of these are clear and well selected to illustrate disease symptoms recognisable in the field. A few are of poor quality and may perhaps be replaced in a second edition. One weak point is the omission of a scale of magnification from the figures of thrips and Red Spider reproduced from a French publication.

The names *Botryotinia theae* Hainsworth and *Ciboria theae* Hainsworth on p. 105 are nomina nuda shortly to be validated by formal diagnosis elsewhere.

R. W. G. Dennis.

Pharmacognosy.*—The 6th edition of this well known standard work is similar to the 5th edition (1949) in general arrangement. Part I—General Principles—includes short chapters on the history, commerce, enzymes, cultivation and storage of drugs, and on insect pests. Part II—Drugs of Vegetable Origin—is the largest and most important section. Together with Part III—Drugs of Animal Origin—it is comprised mainly of detailed descriptions of crude drugs, their sources and uses, arranged systematically. The families of flowering plants, which are still the principal sources of drugs, are arranged according to Rendle. Part IV is devoted to Chemistry and Part V to Microscopy.

In the course of general revision the author has found it necessary to omit some sections and to condense others in order to make way for necessary additions on such subjects as Antibiotics, Alginates, Mastic, *Ammi visnaga*, Kurchi bark (*Holarrhena antidysenterica*), *Rauwolfia serpentina*, *Hyoscyamus muticus* and Partition Chromatography. The references, which are much more numerous than in previous editions, are now conveniently situated at the ends of chapters, instead of being scattered as footnotes. The virtual omission of explanatory footnotes may be regretted however. A few of the plant names are not in accordance with accepted modern botanical nomenclature. Whilst this is to be regretted it is unfortunately almost inevitable and will remain so until a system is devised to stabilise the nomenclature of economic plants.

S. G. Harrison.

* " Textbook of Pharmacognosy " by G. E. Trease, 6th Edition, pp. 821. Baillière, Tindall & Cox, 1952. 37s. 6d.

DIANELLA ENSIFOLIA : A NEW GENERIC RECORD FOR CONTINENTAL AFRICA.

H. Wild.

Government Herbarium, Salisbury, Southern Rhodesia.

In October 1950 the present writer spent several weeks collecting in the Melsetter District of Southern Rhodesia. This area, in the south-eastern corner of the colony, varies in altitude from about 900–2100 m., (3000–7000 feet) and has a rainfall of from 1143–1778 mm. (45–70 inches) per annum, i.e. it is a good deal higher and wetter than the rest of Southern Rhodesia, except for the Inyanga range farther north. It is bordered on the east by the Chimanimani Mts., composed of rugged, grey quartzite crags of pre-cambrian origin, lying along the border with Portuguese East Africa, and to the west of this range, consists of more rounded mountain masses of dark brown Umkondo series quartzites which are of earlier pre-cambrian or possibly palaeozoic origin. This latter formation is also rather frequently interspersed with dolerite dykes and sills. Together with the Inyanga district, also along our eastern border, it has by far the richest flora of any part of Southern Rhodesia and, as has been pointed out earlier (Weimarck, 1941), constitutes a sub-centre in the discontinuous distribution of the Cape element of the African flora. The vegetation of the Chimanimani is dominated by shrubby, heath-like species, of which members of the following genera are typical : *Erica*, *Philippia*, *Muraltia*, *Phylica*, and *Struthiola*. The Umkondo and dolerite hills to the west are, on the other hand, covered by rounded, grassy slopes with protected hollows and streamsides filled with evergreen forest. These last are in all probability relics of a once more widespread forest element, and in them members of the following genera, *Chrysophyllum*, *Craibia*, *Syzygium*, *Ekebergia* and *Maba*, are perhaps most frequent.

In the course of this particular visit many novelties and species new to the Southern Rhodesian flora were found. Among these was *Dianella ensifolia*, growing on the floor of a forest patch which followed a stream on the Tarka forest reserve, some 32 km. (20 miles) south of Melsetter village. At first sight it had the appearance of a blue-flowered *Aneilema* sp. but a later examination, confirmed by Mr. J. P. M. Brenan of the Kew Herbarium, revealed its true identity. The forest patch was evergreen and the following woody species were noticed : *Craibia brevicaudata* (Vatke) Dunn, *Teclea nobilis* Del., *Cephalanthus natalensis* Oliv., *Cassinopsis ilicifolia* (Hochst.) O. Kuntze and *Rutidea syringoides* (Webb) Brem., the last being a woody liane. On the damp forest floor the following herbs accompanied *Dianella ensifolia* : *Dietes prolongata* (Bak.) N. E. Br., *Brillantaisia subulugurica* Burkill, *Streptocarpus eylesii* S. Moore and *Chironia gratissima* S. Moore. This part of Southern Rhodesia is but thinly settled, no gardens were within several miles of the locality and there was no evidence that the plant could have been a garden escape. Finally, individual *Dianella* plants were few and far between and some difficulty was experienced in securing a representative gathering.

In December of the same year the fact that the Tarka plants were not an isolated occurrence was proved when Miss K. E. Sturgeon, of the

Government Herbarium, Salisbury, visited Melsetter and rediscovered the species in fruit, in a similar forest patch, at the foot of the Chimanimani Mts., on the Martin Forest Reserve some 9·6 km. (6 miles) east of Melsetter village.

In addition, when the Tarka gathering was authentically named, a more careful examination of material in the Salisbury Herbarium was made and it then became apparent that two other sheets of rather poor material were also identical. Both of these were from the Chimanimani range but ecological notes are lacking. One of them, however, from the Portuguese East African side of the range (*R. C. Munch* 215), has much shorter internodes, narrower and more coriaceous leaves than the Tarka plant and very likely comes from a more open situation.

This species, extending from Madagascar and the Mascarene Islands through Asia to Australia, belongs to a genus not recorded so far from continental Africa and so these gatherings constitute a very interesting extension of its known range of distribution. Phytogeographical connections between Australia and this part of tropical Africa are perhaps of special remark, but if Madagascar and the Mascarene Islands alone are considered, *Dianella* can be added to a short list of genera (e.g. *Neopalissya* Pax, *Coleotrype* C. B. Clarke and *Pseudocalyx* Radlk.) which provide an interesting link between the flora of Madagascar and the Mascarene Islands on one hand and the south eastern corner of Southern Rhodesia on the other (Wild, 1951). There is no doubt that future collectors will add to this already rather significant list.

In conclusion I would like to thank Mr. J. P. M. Brenan for assistance in the compilation of the bibliographical references which follow.

Dianella ensifolia (*L.*) *DC.* in Red., Liliac. **1,** 1, t. 1 (1802) ; Krause in Engl. et Prantl, Nat. Pflanzenf., ed. 2, **15a,** 295 (1930).

Dracaena ensifolia L., Mant. 63 (1767).

Dianella nemorosa Lam., Encycl. Méth. **2,** 276 (1786) ; Schlittler in Mitteil. Bot. Mus. Univ. Zürich **163,** 256 (1940).

Southern Rhodesia. Melsetter District. On forest floor, Tarka, alt. 1520 m., 10 Oct. 1950, *H. Wild* 3569 (G.H. 30391) :—1 m. high, erect ; flowers pale blue. Melsetter District. Under riverine forest round waterfall at foot of Chimanimani Mts., Martin Forest Reserve, alt. 1200 m., 31 Dec. 1950, *K. E. Sturgeon* in G.H. 30867 :—fruits bright royal blue. Melsetter District. Chimanimani Mts., 22 May 1942, *Weiste* in G.H. 9142.

Portuguese East Africa. Chimanimani Mts., 6 Jun. 1949, *R. C. Munch* 215 (G.H. 24440) :—to 0·7 m. tall ; flowers unopened, probably blue.

REFERENCES

Weimarck, H. (1941), *Phytogeographical Groups, Centres and Intervals within the Cape Flora,* Lunds Univ. Arss., N. F. Avd. 2, Bd **37,** Nr 5.

Wild, H. (1951), *Some Records of Phytogeographic Interest from Southern Rhodesia,* Proc. and Trans. Rhod. Sci. Assn., Vol. **43 :** 54.

SOME WEST INDIAN COLLECTIONS REFERRED TO HYGROPHORUS FR.

R. W. G. Dennis.

With the exception of *Hygrophorus subpratensis* Murr. collections of the fungi described below were made by the writer in Trinidad or Jamaica in the autumn or winter of 1949. All were studied and drawn while fresh and a duplicate set of the coloured figures, accurately copied by Miss D. Kong, was deposited at the Imperial College of Tropical Agriculture, Trinidad. A third set has been presented to the Science Museum, Institute of Jamaica. In the present paper only those species are figured which have some distinctive feature recognisable in a line drawing.

Hygrophorus *Fr.*, Flora scanicam, 339 (1835).

Type species : *Agaricus eburneus* Bull. ex Fr.

Hygrophorus is conventionally divided into three subgenera, sometimes raised to generic rank, viz. *Limacium*, *Camarophyllus* and *Hygrocybe*.

Only one of the West Indian collections, viz. that referred to *H. subpratensis* Murr. seems likely to be a typical *Limacium* but I am unfortunately unable to check its tramal structure as only the drawing was preserved by the collector. In drawing up the key it has seemed more practical to ignore the division of the remaining species into *Camarophyllus* and *Hygrocybe* but the descriptions will be found under these subgeneric headings in the text.

Key to the species of *Hygrophorus*.

I Pileus surface a hymeniform layer of pyriform cells
H. sp. near *hymenocephalus*

II Pileus surface of parallel or woven hyphae :—

A. Spores nodulose, pileus black . . . . . *H. nodulisporus*

B. Spores smooth :—

1. Entire fungus pure white, small :—

α Cystidia present . . . . . *H. subaustralis*

β Cystidia absent :—

*Pileus and stipe very viscid . . . . . *H.* sp.

**Pileus and stipe dry, or at most the pileus clammy :—

†Pileus umbilicate, spores subglobose . . . *H. buccinulus*

††Pileus convex, spores elliptical . . . . . *H. borealis*

2. Pileus coloured (white with age except at the umbo in *H. subpratensis*)

α Pileus and stipe very slimy

*Pileus yellowish brown becoming white, stipe white *H. subpratensis*

**Pileus bright red or yellow, stipe yellow

†Gills adnato-decurrent . . . . . *H. hondurensis*

††Gills free . . . . . *H. lutei-stipes*

β Pileus at most clammy in wet weather, stipe not viscid.

*Whole fungus blackening at a touch . . . . *H. erinaceus*

**Not blackening

†Stipe dark red except at the base, pileus concolorous

‡Spores 11–13 × 5–6μ . . . *H. firmus var. trinitensis*

‡‡Spores 14–18 × 8 and 6 × 3μ, basidia markedly dimorphous . . . . . *H. firmus*

††Stipe white, orange, brown or gray :—

‡Spores up to 11μ long, basidia of uniform size :—

§ Gills free, spores 9–10 × 7–8μ . . . . . *H. earlei*

§§ Gills adnate or decurrent :—

| Pileus brown :—

◊ Spores globose or subglobose :—

// Spores 4·5–5·5μ . . . . . *H. umbrinus*

// // Spores 6–8 × 5–5·5μ . . . . . *H. bakeri*

◊ ◊ Spores elliptical

// Pileus perforate, stipe gray . . *H. cinerascens*

// // Pileus imperforate

= Stipe light yellow . . . . . *H. erinensis*

≡ Stipe brown

? *H. subradiatus* sensu Smith & Hesler

|| Pileus orange, small, scurfy tomentose, spores 6–7 × 4 *H. cantharellus*

||| Pileus yellow :—

◊ Pileus flat or umbilicate, flesh white, spores 8 × 5·5μ *H. cremeus*

◊ ◊ Pileus papillate, flesh yellow, spores 8–11 × 5·5–7μ *H. papillatus*

|||| Pileus conico-campanulate, red or yellow, spores 7–10 × 4–5μ . . . . . *H. subflavidus*

||||| Pileus red :—

◊ Pileus convex then flattened, red, spores 6–9 × 3–3·5μ . . . . . *H. troyanus*

◊ ◊ Pileus minute, spores 8 × 6μ . . . See *Mycena*

‡‡Many spores exceeding 11μ long, basidia dimorphous :—

§ Large yellow sporophore with broadly elliptical spores *H. firmus* var. *occidentalis*

§§ Pileus red, stipe white then yellow *H. firmus var. militaris*

§§§ Pileus dark purple, stipe yellow . . *H. firmus var. purpureus*

Subgenus **Limacium** Fr. Type species that of the genus.

Hygrophorus subpratensis Murr. in Mycologia **3,** 199 (1911).

Pileus at first campanulate, isabella colour, becoming expanded up to 5 cm. wide with a low broad umbo, white, chamois at the umbo only, covered with a thick glutinous pellicle, not striate ; flesh white ; gills distant, adnexed, white ; stipe cylindrical, white, smooth, viscid. Spores subglobose 5-6 × 4–4·5μ basidia clavate, 23 × 6μ, 4-spored, spore print white, becoming yellowish with age. Terrestrial.

Collections seen :—Botanic Station, Antigua, *E. M. Wakefield* 15 A (drawings only).

Cuba : on lawn, Santiago de las Vegas, 1.VI.1905, *F. S. Earle* 373 (typus).

Subgenus **Camarophyllus** Fr. Epicrisis 325 (1838) as tribus.

Type species : *Agaricus camarophyllus* Alb. et Schw. ex Fr.

A. Pileus surface hymeniform.

Hygrophorus sp. near **hymenocephalus** *Smith & Hesler.*

Pileus up to 4 cm. broad, expanded, smooth, minutely pruinose under a lens, drab ; flesh thin except at the disc, flexible, pale smoke gray ; gills broad, distant, of 2 -3 lengths, adnato-decurrent, veined at the base, pale smoke-gray becoming drab ; stipe tapering to the base, smooth, solid, concolorous with the pileus. Spores subglobose 4–5 × 3–4μ, non-amyloid, basidia 4-spored, about 40 × 6μ, gill edge fertile, no cystidia ; trama of interwoven thin-walled hyaline hyphae 8–15μ wide, yellowish-brown in Melzer's reagent, pileus surface a layer of brown-walled hyphae 4–5μ wide bearing thin-walled pyriform cells 30–40 × 12–25μ in a pseudohymenium. Solitary, terrestrial.

Collection seen :—Trinidad : bamboo plantation, St. Joseph, 20.X. 1949, *Dennis* 201. Only a single rather old sporophore was seen and it is desirable that search be made for younger material to check with Smith and Hesler's description of *Hygrophorus hymenocephalus* from North Carolina and Tennessee, which apparently differs mainly in its much smaller size. Dennis 201 also bears a remarkable resemblance to *Tricholoma atrobrunneum* but its spores appear consistently non-amyloid.

B. Pileus surface hyphal.

Hygrophorus sp. near **obconicus** *Peck.*

Pileus 1·5 cm. convex, flat at the disc, white, very viscid ; flesh thin, white, odourless ; gills narrow, shortly decurrent, of three lengths, white ; stipe white, solid, viscid. Spores elliptical, 4–5 × 3–4μ a few up to 7 × 4μ, with a large oil globule, basidia clavate-cylindric, 4-spored, 22 × 5μ, no cystidia ; tramal hyphae slender, woven, yellow in Melzer's reagent ; pileus surface of slender thin-walled hyphae 2μ wide, very loosely woven in colourless mucilage. Terrestrial in very wet mossy forest.

Collection seen : Venezuela, El Junquito, 16.XI.1949, *Dennis* 358.

This curious little fungus differs from most species of *Hygrophorus* in its small basidia and spores. In these and apparently in hyphal structure,

it approaches *H. chromus* Peck as redescribed by Smith and Hesler (1942) from the Great Smoky Mountains, but that species is not viscid, is "tinged avellaneous" and has a hollow stipe. In spite of its small basidia I do not think my 338 is a *Mycena* or *Omphalina* but as the collection contained only a single sporophore it seems inadvisable to found on it a new species of *Hygrophorus* until confirmatory material is available.

Hygrophorus buccinulus (Speg.) *Dennis*, comb. nov.

Clitocybe buccinula Speg. in Bol. Acad. Nac. Ciene. Cordoba. **11,** 388 (1889).

Marasmiellus buccinulus (Speg.) Singer in Lilloa **22,** 299 (1951).

Pileus 1–4·5 cm. diameter, convex with a small umbilicus, dry, silky, white; flesh thick, white, odourless; gills subdistant, thick, narrow, decurrent, white; stipe tapering downwards, undulating, dry, fibrous, white, solid or becoming hollow above with age. Spores subglobose to broadly elliptical, 7·8 (–10) × 6·7 μ, contents oily, non-amyloid, basidia clavate, 63–75 × 10 μ, 4-spored, trama of interwoven hyphae, pileus surface of radiating hyphae 4–5 μ wide. Terrestrial on bare soil. Fig. 1.

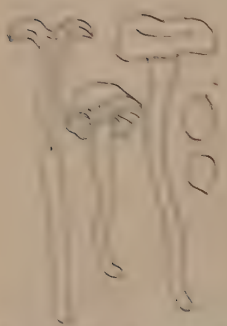


Fig. 1. *Hygrophorus buccinulus*. Spores × 660.

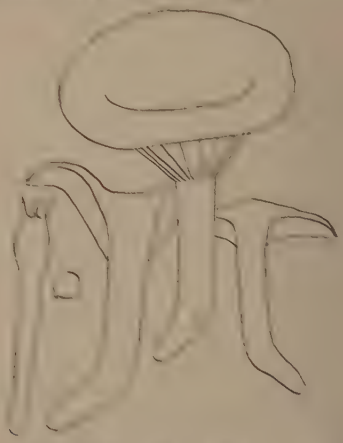


Fig. 2. *Hygrophorus umbrinus*. Spore and basidium × 660.

Collections seen :—Trinidad : under bamboos, St. Joseph. *R. E. D. Baker* 1359, 2.IX.1947 ; same locality 27.IX.1949. *Dennis* 84 ; Brazil : Apiahy, *Puiggari* 2885, April 1888 (Typus).

Identification of my number 84 with *Clitocybe buccinula* Speg. is offered with some diffidence for the typus is mouldy and Singer (1952) has already proposed a different interpretation of it. He described as *Marasmiellus buccinulus* (Speg.) Sing. a tough thinfleshed fungus, with spores 3·6–5 × 2·2–3 μ. This is contradicted by the spores, certainly not mould spores, drawn by Spegazzini on the type packet and measured by him as 10 × 6 μ. The habitat of the type collection, "ad terram nudam argillaceam", agrees with my 84 but apparently also with Singer's fungus. Baker 1359 was published by Baker and Dale (1951) as *Omphalina subcorticata* Murr. but A. H. Smith finds the spores of that species to be 7—8 (–9) × 4–5 μ.

Hygrophorus borealis *Peck* 26th Report New York State Mus. 64 (1874).

Camarophyllus borealis (Peck) Murrill, N. American Flora **9,** 385 (1916).

Omphalina tepeitensis Murrill, N. American Flora **9,** 348 (1916).

Pileus hemispherical, about 1 cm. across, white, smooth, non-viscid; flesh thin, white, odourless; gills broad, thick, equal, arched, adnato-decurrent, white, stipe equal, smooth, dry, white, solid. Spores 7–10 × 4·5–6μ, basidia 2 or 4 spored, 40–50 × 6–7μ, gill edge fertile, no cystidia. Sporophores solitary, terrestrial.

Collections seen :—Jamaica : amongst moss, Cinchona, 5500′, Blue Mts., 20.XII.1949, *Dennis* J 37 ; Mexico : 7000′ moist virgin forest along Tepeite river, Cuernavaca, 28.XII.1909, *W. A. and E. L. Murrill* 479 (Typus of *O. tepeitensis*).

The above collections are scarcely separable from the common European *H. niveus* (Scop.) Fr. which Lange has shown to occur in two and four-spored forms with spores 9–10 × 5·5–6μ and 7 × 5μ respectively. Smith and Hesler (1942), however, regard *H. niveus* as a viscid species and call the above non-viscid form *H. borealis* Peck.

Hygrophorus umbrinus *Dennis*, spec. nov.

Pileus 5 cm. latus, expansus, umbonatus vel depressus, glaber vel innato-fibrillosus, griseo-brunneus vel avellaneus ; caro firma, alba ; lamellae albae dein pallide bubalinae, latae, margine obtusae, decurrentes ; stipes basi attenuatus, albus dein avellaneus, fibrosus, solidus ; sporae globosae 4·5–5·5μ latae, examyloideae ; basidia tetraspora ; cystidiae nullae. Ad terram inter bambusas, St. Joseph, Trinidad, *Dennis* 177, Typus. Fig. 2.

This fungus has a somewhat bilateral trama and hence might be referred by some authors to *Limacium* in spite of its perfectly dry pileus. The gills have a thin core of almost parallel hyphae 3–4 wide, the remainder intricately interwoven, pileus trama of interwoven hyphae 4–5 wide, pileus surface of radiating thin-walled hyphae 4–5 wide with large clamp connections. Superficially it resembles members of the *H. pratensis* stirpe, differing from *H. colemannianus* Blox. and *H. subradiatus* Fr. sensu Lange in its smaller spores, from *H. albipes* Peck and *H. basidiosus* Peck in lacking a pellicle of slender subgelatinous hyphae and from *H. sphaerosporus* Peck in the slender tramal hyphae. Were it not for the plate of parallel hyphae down the centre of the gill I would suggest treating *H. umbrinus* as a colour form of *H. canescens* Smith and Hesler. But that was a *Camarophyllus* in their restricted sense, which presumably implies that the gill trama is irregularly woven throughout.

Hygrophorus cremeus (*Murr.*) *Dennis*, comb. nov.

Omphalina cremea Murr., N. American Flora **9,** 350 (1916).

Pileus up to 4 cm. diameter, convex, then expanded, flat or slightly umbilicate at the disc, warm buff to light buff, smooth, dry ; flesh thin, white ; gills broad, thick, subdistant, of two lengths, decurrent, veined at the base, light ochraceous buff ; stipe equal or slightly enlarged upwards, smooth, dry, white, solid. Spores broadly elliptical 8–9 × 4·5–

6μ, with a large oil drop, gill edge sterile, of undifferentiated hyphal tips, no pleurocystidia, basidia clavate-cylindric, 35–40 × 7μ, 4 spored ; trama of thin-walled hyaline hyphae 5–7μ wide, interwoven in the gills.

Collections seen :—Trinidad, under bamboos, St. Joseph 27.IX.1949, *Dennis* 73, again 30.XI.1949 ; Jamaica : on a very decayed stump. Chester Vale, 22.XII.1908, *W. A. and E. L. Murrill* 353 (Typus).

In its thick gills and long basidia this species is evidently allied to the *H. pratensis* stirpe rather than to *Omphalina* ; indeed it might be treated as a variety of *H. pratensis* with yellower gills and paler stipe than the type.

Hygrophorus bakeri *Dennis*, spec. nov.

Pileus 2·5 cm. latus, convexus, umbilicatus, avellaneus, sordide striatus, glaber ; caro tenuissima, alba ; lamellae subdistantes, decurrentes, exiguae, albae ; stipes tenuis, albus, glaber, solidus, basi attenuatus ; sporae subglobosae, apiculatae, 6–8 × 5-5·5μ examyloideae ; basidia tetraspora, cylindrico-clavata, 35–40 × 5–6μ ; cystidiae nullae. · Ad terram inter bambusas, St. Joseph, Trinidad, *Dennis* IIA, Typus. Fig. 3.

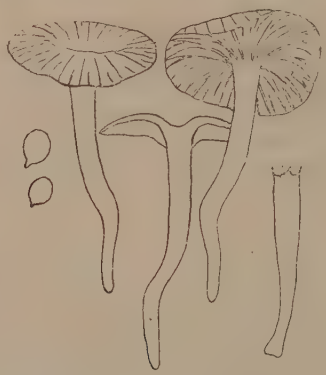


Fig. 3. *Hygrophorus bakeri.* Spores and basidium × 660.

The tramal hyphae are hyaline, thin-walled, 6–12μ wide, subparallel in the centre of the gill, irregularly woven towards its sides, pileus surface of radiating hyphae 5·5–7μ wide with clamp connections.

This beautiful little fungus might be sought in *Omphalina* but the long cylindrical basidia indicate its relegation to *Hygrophorus*. *H. albipes* Peck and *H. sphaerosporus* Peck differ in their obtuse pilei and viscid pellicle.

Hygrophorus sp. cf. *H. subradiatus* sensu Smith and Hesler 1942.

Dennis 184 A is a collection of two sporophores on bare soil beside the path to Maracas waterfall, Trinidad, 25.XI.1949. These were fully expanded and just possibly represent old, robust specimens of *H. cinerascens* but the umbilicus was not continuous with the cavity of the stipe. Until more collections have been studied in the field it is difficult to assess the value of this character.

The cuticular hyphae are 6–8μ wide, with clamp connections and gray-brown sap, basidia 40–45 × 8–9μ, 4-spored, spores 7–10 × 4–5μ. This material agrees tolerably with *H. subradiatus* Fr. in the sense of Smith and Hesler.

Subgenus **Hygrocybe** Fr. Epicrisis, 328, 1838, as tribus.

Type species : *Agaricus conicus* Scop. et Fr.

A. Spores nodulose.

Hygrophorus nodulisporus *Dennis* spec. nov.

Pileus 2·5 cm. latus, convexus, subumbilicatus, sericeus, niger ; caro tenuis, nigra, hygrophana ; lamellae subdistantes exiguae, crassae, adnato-decurrentes, griseae, saepe furcatae ; stipes cylindricus, glaber, griseus, fistulosus ; sporae ellipticae, 9–10 × 6–8μ, nodulosae, nodulis obtusis, 1 × 1μ, examyloideae ; basidia cylindrico-clavata, tetraspora, 48–58 × 7–11μ ; cystidiae nullae. Ad terram, Upper Caura Valley, Trinidad, *Dennis* 385 Typus. Fig. 4.

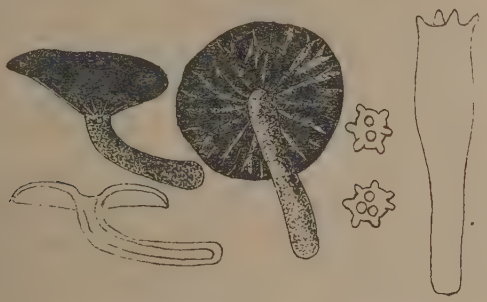


FIG. 4. *Hygrophorus nodulisporus*. Spores and basidium × 660.

The spores of *H. nodulisporus* are like those of a *Mycenella* but its whole aspect is that of a Hygrophorus. The very long basidia indicate affinity with that genus as also does the complete absence of cystidia. The gill trama consists of woven hyphae 5–6μ wide, permeated by a few dark staining vermiform hyphae 3–5μ wide ; pileus surface of parallel thin-walled hyphae 4–11μ wide with gray-brown sap.

B. Spores smooth.

Hygrophorus subaustralis *Smith et Hesler* in Lloydia **5,** 46 (1942).

Pileus 12 mm. diameter, convex with a conical umbo, smooth, pure white ; flesh thin, watery gray drying white, odourless ; gills subdistant, adnate with a tooth, of two lengths, white ; stipe equal above a slightly swollen base, white, solid, surface longitudinally fibrillose. Spores subglobose, 4·5–7 × 4–5·5μ, basidia clavate, two or four spored, 25–30 × 6–7μ, cheilo and pleurocystidia similar, delicate, ventricose with long tapering apices, 45–60 × 8μ below, 2–3μ above ; pileus surface of thin-walled hyaline hyphae about 8μ wide with scattered colourless

squamules on their walls, tramal hyphae similar, cells about 100 × 25μ. Terrestrial. Fig. 5.

Collection seen :—Trinidad : on crest of northern range north of Arima 25.IX.1949, *Dennis* 51.

The spores run a little larger than those described by Smith and Hesler (4·5 × 3·4μ) but some variation in spore size is to be expected in *Hygrophorus*, especially where the number of sterigmata is variable.

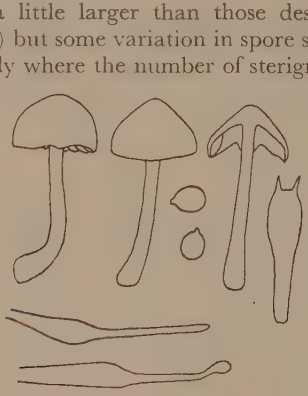


Fig. 5. *Hygrophorus subaustralis*. Spores, basidium and cheilocystidia × 660.

Hygrophorus erinaceus *Pat.* in Bull. Soc. Myc. France **25,** 10 (1909). sensu Petch Ann. R. Bot. Gard. Peradenya **6,** 325 (1917).

Hygrophorus conicus Scop. ex Fr. var. *Peradenyca* Sacc. Syll. fung. V. p. 418, 1887.

Pileus conical with an acute umbo, then conico-campanulate, up to 3 cm. diameter, pale smoke gray or barium yellow, streaked with black fibrils, blackening throughout when touched ; flesh thin, soft, hygrophanous, gray or yellow in the pileus, gray in the stipe, blackening ; gills subdistant, of two lengths, free, broad, white, blackening ; stipe approximately equal, hollow, white to pale smoke gray, fibrillose, blackening. Spores broadly elliptical, 10 × 5μ, to subglobose 7 × 6μ on the same gill, print white, basidia four spored, 30–40 × 7–11μ, tramal hyphae parallel in the gill, their tips forming a sterile edge.

Collections seen :—Trinidad, bamboo plantation, St. Joseph, 20.X. 1949, *Dennis* 72A (yellow pileus) ; same locality 27.IX.1949, *Dennis* 72 (gray pileus).

In Europe it is customary to recognise two conical blackening species of *Hygrophorus*, *H. conicus* Scop. ex Fr. with spores 10–12 × 6–6·5μ on two-spored basidia and *H. nigrescens* (Quél.) Quél. with spores 9–11 × 5–6μ on four-spored basidia. Smith and Hesler (1942) regard the number of sterigmata as of no specific value and use for both forms the older name *H. conicus*. They find this to be variable in spore size but the spores are always elliptical, 9–12 (–14) × 5–7μ or 7–10 × 4–6μ in the four-spored forms. The Trinidad collections have four spored basidia but have a greater tendency to bear subglobose spores than has typical *H. nigrescens*. In this they approach *H. erinaceus* Pat. described from Annam with spores 6 × 4μ. Petch has used this name for the fungus Berkeley and Broome described from Ceylon as *H. conicus* Fr. var., named by Saccardo *H. conicus* (Scop.) Fr. var. *Peradenyca* Sacc. He finds the spores of the

Ceylon form to be 6–10 × 5·8μ. The spore size is evidently variable and I have long hesitated to identify the Trinidad collections with *H. erinaceus* which was described as having the pileus " recouvert de petites écailles noirâtres, retroussées, lui donnant un aspect tout hérissé." Stipe and pileus alike were " jaune de cadmium très clair ", in that respect like Dennis 72 A but none of the Trinidad sporphores has the pileus other than smooth with innate fibrils. Nevertheless the drawing of my 72 A closely matches Berkeley's copy of the drawing No. 813 of Thwaites 329, on which *H. conicus* var. *Peradenyca* was founded. I have therefore adopted the name *H. erinaceus* Pat. sensu Petch, though Saccardo's treatment as a variety of *H. conicus* is probably a better indication of the status of this plant.

Hygrophorus cinerascens Berk. et Br. J. Linn. Soc. Bot. **11,** 562 (1871). emend. Petch, Ann. R. Bot. Gard. Peradeniya **6,** 324 (1917).

Fig. 6. *Hygrophorus cinerascens.* Spores and basidium × 660.

Pileus hemispherical, becoming campanulate, then expanded, 4 cm. diameter, with a small umbilicus which is perforated at a very early stage to communicate with the cavity of the stipe, fibrillosely striate, fuscous, very dark when young, paling and exposing the drab-gray flesh between the fibrils with age, drying black ; flesh thin, very hygrophanous ; gills subdistant, of two or three lengths, adnato-decurrent, thick and wedge-shaped in section, drab-gray ; stipe tubular, smooth, at first equal, whitish, becoming obconical as the pileus expands and the central perforation enlarges, finally drab-coloured. Spores elliptic-cylindric, 8–11 × 4–5·5μ, print pure white, non-amyloid, basidia 4-spored, 40 × 8μ, gill edge fertile, no cystidia, trama of parallel hyphae 14–20μ wide, pileus surface of parallel hyphae with thin-walled cells 85–150 × 10–11μ, filled with brown sap, clamp connections present. Sporophores scattered, terrestrial. Fig. 6.

Collections seen :—Trinidad : St. Joseph, under bamboos, 18.X.1949, Dennis 184. This seems to be the West Indian representative of *H. ovinus* Fr. from which it differs in its slender stature and perforate pileus. The mysterious *H. variolosus* Fr. from Costa Rica differed in its solid stipe

and scaly pileus and has been tentatively identified by Murrill with *Oudemansiella canarii*. Petch noted a strong nitrous smell not recorded in the Trinidad collection so further study may make it possible to separate the races of the fungus in the eastern and western tropics.

Hygrophorus erinensis *Dennis*, spec. nov.

Pileus 1·5 cm. latus, convexus dein subumbilicatus, cinnamomeo-brunneus, umbilicato minute squamuloso ; caro tenuis, alba ; lamellae subdistantes, adnatae, albae ; stipes cylindricus, tenuis, fistulosus, glaber, nitidus, luteolus ; sporae ellipticae 8 11 × 6–7μ basidia tetraspora 50 × 10μ ; cystidiae nullae. Solitarius ad terram inter Bactris, Erin Savanna, Trinidad, Dennis 302, Typus. Fig. 7.

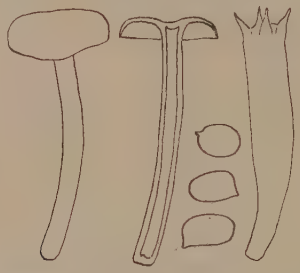


Fig. 7 *Hygrophorus erinensis*. Spores and basidium × 660.

In habit this suggests a brown variety of *H. firmus* but the basidia are not dimorphous. It also somewhat resembles *H. nitratus* var. *glauco-nitens* (Fr.) Bres. (Bresadola Tab. CCCLIV, 1) which has spores 9–11 × 5–6μ but a brown stipe and nitrous odour. *H. erinensis* has a pileus surface of thin-walled, parallel, radiating hyphae, the cells about 70–80 × 9μ filled with gray-brown sap, with clamp connections. Solitary on bare soil.

Hygrophorus cantharellus (Schw.) Fr. in Epicrisis, 329 (1838).

Agaricus cantharellus Schw. in Schr. Nat. Ges. Leipzig **1,** 88 (1822).

Hydrocybe cantharellus (Schw.) Murr. in Mycologia **3,** 196 (1911).

Camarophyllus cantharellus (Schw.) Murr. in N. American Flora **9,** 388 (1916).

Pileus up to 1·5 mm. diameter, convex, flat or slightly depressed at the disc, surface minutely scurfy-squamulose, ochraceous-orange shading to yellow at the margin ; flesh thin, ochraceous-orange throughout ; gills subdistant, equal, broad, shortly decurrent, yellow ; stipe equal or slightly enlarged upwards, concolorous with the pileus, the base yellowish, smooth, dry. Two-spored and four-spored basidia occur on the same gill and the spores are hence very variable, 6–7 × 4μ to 8–12 × 5–7μ. No cystidia. Solitary, terrestrial.

Collection seen :—Jamaica : amongst moss, 5500′, Cinchona, Blue Mts., 20.XII.1949, Dennis J. 34.

The yellow form with large spores, 9–12 × 5–7μ, published by Baker and Dale (1951) from St. Joseph, Trinidad, 9.VIII.1947, would appar-

ently be called *H. turundus* Fr. by Smith and Hesler (1942). This species has, however, been variously interpreted. In the sense of Lange it appears to be what Smith and Hesler call *H. miniatus* var. *sphagnophilus* Peck.

Hygrophorus papillatus *Dennis* spec. nov.

Pileus 2 cm. latus, campanulatus, umbone acuto, minute fibrillosus, luteus, umbone luteo-ochraceus ; caro tenuis, lutea ; lamellae subdistantes, arcuatae, luteae, subdecurrentes ; stipes cylindricus, solidus, glaber, luteus, deorsum pallidus, strigosus ; sporae ellipticae 8 11 × 5·5–7μ ; basidia tetraspora, 15μ crassa ; cystidiae nullae. Ad fragmenta dejecta in silvis, Northern Range, Trinidad, Dennis 49, Typus. Fig. 8.

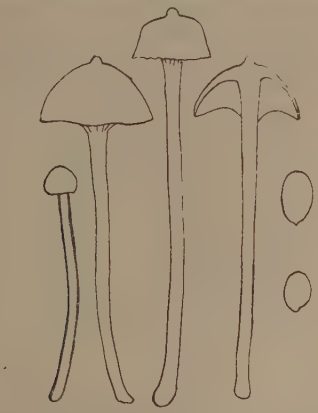


Fig. 8. *Hygrophorus papillatus*. Spores × 660.

Hygrophorus earlei (*Murr.*) *Murr.* in Mycologia **4,** 332 (1912).
Hydrocybe earlei Murr. in Mycologia 3, 196 (1911).

Pileus campanulate, becoming convex, then expanded with a broad low umbo, shading from lemon to zinc orange, smooth, shining but scarcely viscid, somewhat pellucidly striate when old ; flesh thin, orange in the pileus, white to lemon in the stipe, hygrophanous ; gills white becoming warm buff, broad, ventricose, adnexed, of two lengths, rather crowded ; stipe equal, smooth, dry, hollow, shading from baryta yellow above to white at the base. Spores broadly elliptical, 7–8 (–11) × 5·5–7μ, basidia 4-spored, 40 × 8–9μ, no cystidia, pileus surface of parallel radiating hyphae of various widths. Terrestrial.

Collections seen :—Cuba : in pasture, Herradura, Santiago de las Vegas, 16.VI.1907, *F. S. Earle* 562 (Typus) ; Antigua : amongst grass, Cade's Bay, *E. M. Wakefield* 15 ; Trinidad : beside trail on crest of northern range N. of Arima, 25.IX.1949, *Dennis* 50 ; on bare soil under *Theobroma*, Non Pareil, Sangre Grande, 11.X.1949, *Dennis* 161.

Hygrophorus hondurensis (*Murr.*) *Murr.* in Mycologia **4,** 332 (1912).
Hygrocybe hondurensis Murr. in Mycologia **3,** 197 (1911).

Pileus convex, soon expanded, sometimes slightly umbilicate, margin undulating, pellucidly striate, diameter 1 1·6 cm., very viscid, colour

varying from grenadine red to light cadmium ; flesh thin, deep yellow, hygrophanous ; gills rather narrow, subdistant, shortly decurrent, ivory yellow ; stipe equal, often curved, viscid, lemon yellow to deep chrome. Spores broadly elliptical or oval, 5·5 8 × 3–4·5μ, basidia clavate, 2-spored and 4-spored on the same gill, the former 25 32 × 7·8μ the latter somewhat shorter, no cystidia, pellicle of the pileus formed of loosely woven hyphae 5μ wide embedded in mucilage, underlying epidermis of thin-walled hyphae 25μ wide filled with yellow sap. Terrestrial, gregarious. Fig. 9.

Collections seen : Trinidad : under bamboos beside the Macqueripe trail, Diego Martin, 29.IX.1949, *Dennis* 91 ; same locality 27.X.1949, *Dennis* 91 B. British Honduras : *M. E. Peck* 1906 (typus).

Fig. 9. *Hygrophorus hondurensis.* Spore and basidium × 660.

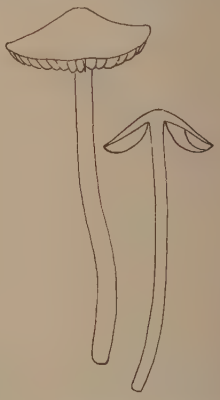


Fig. 10. *Hygrophorus luteistipes.*

Hygrophorus luteistipes *Dennis*, spec. nov.

Pileus hemisphaericus vel campanulatus, dein expansus, 2 cm. latus, umbone obtuso, viscidus, coccineus vel aurantiacus, luteo-striatus ; lamellae subdistantes, adnexae dein liberae, albae dein eburneae, margine denticulatae, 2 mm. latae ; stipes cylindricus, undulatus, solidus, citrino-luteus, viscidus ; sporae ellipticae, 5–8 × 3–4–(6)μ ; basidia tetraspora ; cystidiae nullae. Fig. 10.

Gregarius ad terram in silvis. Morne Bleu, Trinidad, *Dennis* 424, Typus.

This species differs from *H. hondurensis*, *H. minutulus* Peck, *H. subminutulus* Murr. and *H. mucilaginosus* Berk. et Curt. in its almost free gills. Its gill trama consists of broad, parallel, thin-walled hyphae and the pileus pellicle of very slender loose hyphae embedded in mucilage.

Hygrophorus troyanus (*Murr.*) *Murr.* in Mycologia **4,** 332 (1912).

Hydrocybe troyana Murr. in Mycologia **3,** 198 (1911).

Pileus hemispherical, then flattened above or somewhat depressed at the disc, up to 2·5 cm. diameter, smooth, slippery but not truly viscid, scarlet shading to orange chrome or apricot orange, margin usually yellowish ; flesh yellow throughout ; gills subdistant, of two lengths,

adnate with a decurrent tooth, salmon orange ; stipe equal, smooth, concolorous with the stipe above, shading to yellow at the base, rather short and stout, hollow. Spores elliptic-cylindric, 6 9 × 3 4μ basidia 4 spored, no cystidia, pileus surface of thin-walled hyphae 3 6μ wide ; gill trama of parallel hyphae.

Collections seen :—Jamaica, Troy, Cockpit Country 2000′, 12–14.I. 1909, *W. A. Murrill and W. Harris* 1090 (Typus) ; trail to Morce's Gap, 24.XII.1949 ; Trinidad : under bamboos, St. Joseph, *R. E. D. Baker* 1852, 10.XII.1947 ; same locality 27.IX.1949, *Dennis* 74 ; Erin, under *Bactris*, 6.XI.1949.

This common fungus seems to be the tropical representative of *H. coccineus* Fr. and is perhaps not specifically separable from the temperate form. Murrill described the gills as violaceous but his type exactly matches my No. 74. *H. subcaespitosus* Murr. differs in its white to straw-coloured gills and broader spores 9–10 × 4·5–5·5μ. *H. subminiatus* Murr. is viscid with spores 8–10 × 5–6μ.

Hygrophorus subflavidus (*Murr.*) *Murr.* in Mycologia **4,** 332 (1912).

Hydrocybe subflavida Murr. in Mycologia **3,** 197 (1911).

Pileus conical to campanulate, yellow to flame scarlet, smooth, becoming very finely fibrillosely scurfy with age, not striate, up to 5 cm. across ; flesh thin, concolorous ; gills crowded, broad, adnate, ascending, straw yellow ; stipe stout, equal, smooth, fibrous, yellow ochre. Spores elliptic-cylindric, 9–12 × 5–7μ, basidia clavate, about 45 × 8–9μ, 2-spored and 4-spored on the same gill ; pileus surface of parallel hyphae 4—5μ wide with yellow sap and clamp connections. Terrestrial.

Collections seen :—Jamaica, Morce's Gap under tree ferns, Blue Mountains, 29.XII.1908 to 2.1.1909, *W. A. and E. L. Murrill* 674 ; in dense mossy forest on limestone, summit of John Crow Peak, W. side of Morce's Gap, *Mr. Proctor*, 26.XII.1949, *Dennis* J 75.

The type is yellow throughout but I have no doubt Mr. Proctor's collection with red pileus, virtually from the type locality, is the same species. Red and yellow variants are common in species of this section of *Hygrophorus* eg. *H. conicus* and *H. nigrescens* in Europe, *H. hondurensis* in the West Indies. Dennis J 75 has dried yellow throughout and is now indistinguishable from the type. Murrill described the spores as globose, 5μ but this is certainly an error, possibly due to accidental confusion with *H. flavoluteus* Murr. from the same region which has spores of that character. The type packet of *H. subflavidus* contains two sporophores. I could obtain no spores from the larger but the smaller yielded broadly elliptical spores 9–12 × 5 7μ. The species is near *H. puniceus* Fr. which differs in its viscid pileus.

Hygrophorus firmus *Berk. et Broome* in J. Linn. Soc. Bot. **11,** 563 (1871).

var. **typicus** Corner in Trans. Brit. Myc. Soc. **20,** 177 (1936).

Pileus 1·5 cm. convex, becoming flattened or depressed, innately fibrilloso-squamulose with erect tufts of fibrils in the umbilicus, scarlet-red ; flesh thin, concolorous, hygrophanous ; gills subdistant, of two or

more lengths, flame-scarlet with yellowish edges ; stipe equal or slightly enlarged at the base, hollow, concolorous with the pileus above, shading to yellow below. Basidia dimorphous, the larger 40 × 15μ clavate, 4-spored, spores 14–18 × 7–8μ, the smaller 30 × 5–6μ, the spores 6 × 3μ ; pileus surface of thin-walled elliptical cells 14–30μ wide.

Collection seen :—Trinidad : on humus in forest, crest of northern range N. of Arima, 25.IX.1949, *Dennis* 48.

A possible synonym is *H. siparius* Berk. from Brazil but I can recover no spores from the type, *Spruce* 130, at Kew.

Hygrophorus firmus *Berk. et Br.* var. **trinitensis** *Dennis* var. nov.

A typo differt sporophoris gracillimis.

Ad terram in silvis, Arena Forest, Trinidad, *Dennis* 124, Typus.

Pileus 3–10 mm. convex, with a shallow umbilicus, dry, silky, slightly scurfy in the umbilicus in large specimens, scarlet with a narrow yellow line round the margin ; flesh thin, concolorous ; gills subdistant, equal, broad, decurrent with a tooth, coral red ; stipe long, slender, equal, dry, smooth, solid, concolorous with the pileus except at the yellowish base. Spores elliptic-cylindric, 6–11–13 × 3·5–6μ, basidia 4 spored, cylindric-clavate, about 40 × 8μ, gill edge fertile, no cystidia ; gill trama of parallel hyphae ; pileus surface of parallel hyphae with thin-walled cells up to 190 × 25μ with red sap. Differs from the type in smaller size and in the basidia not being distinctly dimorphous. Sporophores scattered singly on sandy soil in forests. Fig. 11.

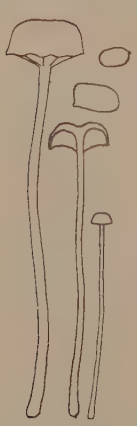


Fig. 11. *Hygrophorus firmus* var *trinitensis*. Spores × 660.

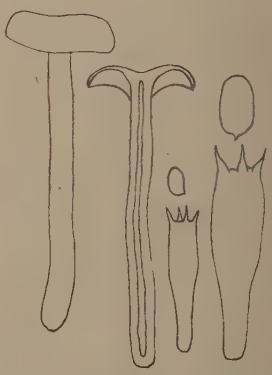


Fig. 12. *Hygrophorus firmus* var *purpureus*. Basidia and spores × 660.

Collections seen :—Trinidad, Arena forest, 2.VIII.1947, *R. E. D. Baker* 1490 ; 5.X.1949, *Dennis* 124 (Typus) ; 30.X.1949, *Dennis* 124 A ; Erin, *Dennis* 124 B.

This little fungus has been repeatedly collected and seems quite constant but it bears too close a resemblance to the *H. firmus* series to be regarded as a distinct species. In spite of great range in spore size the spores do not fall obviously into two size groups as in typical *H. firmus* and the basidia are not obviously dimorphous.

var. **militaris** Corner in Trans. Brit. Myc. Soc. **20,** 177 (1936).

Pileus convex, then flattened or depressed with a downcurved margin, silky, dry, scarlet-red with a yellow line at the margin, up to 4 cm. diameter, gills rather crowded, of two lengths, broadly adnate, light orange-yellow becoming apricot-orange with yellow edges, intervened with age ; stipe equal, dry, smooth, hollow, white with a hint of yellow at the base, becoming orange-buff from the base upwards with age ; flesh red in the pileus, white then yellow in the stipe. Basidia dimorphous, the larger mostly 4-spored, a few apparently 2-spored, 40 × 7–10μ spores elliptical 8–11 × 5–6μ, the smaller 30 × 5μ, 4-spored, the spores 6·7 × 3–4μ no cystidia, gill trama of parallel hyphae, pileus surface of parallel hyphae, the cells 270–400 × 15–30μ, thinwalled, filled with red sap. Gregarious in forest litter.

Collection seen :—Trinidad : 2000′ on Naranja, 27.XI.1949, *Dennis* 382.

H. subcaespitosus (Murr.) Murr. from Cinchona, Jamaica, has a similar habit and spores 9–10 × 4·5–5·5μ but gills " white to stramineus " with the stipe yellow. I did not search for dimorphism in the basidia when examining the type.

Hygrophorus firmus *Berk. et Br.* var. **occidentalis** *Dennis*, var. nov.

A typo differt pileo luteo.

Ad terram in silvis, Siparia, Trinidad, *Dennis* 50A, Typus.

Pileus convex, then depressed and often perforated at the centre, smooth, translucently striate, up to 6 cm. diameter, pale lemon-yellow to apricot yellow ; flesh thin, hygrophanous, concolorous ; gills subdistant, of two lengths, broad, adnate, sulphur-yellow ; stipe smooth, hollow, slightly attenuated upwards, lemon-yellow. Basidia dimorphous, the larger 35 × 9–10μ two or fourspored, the spores broadly elliptical 11–14 × 6 8μ, the smaller more numerous, probably fourspored 30 × 4–5μ with elliptic-cylindric spores 5–6·5 × 3–4μ no cystidia.

Corner has described seventeen varieties of *H. firmus* in Malaya, arranged in two series, Ovalisporae with the larger spores 12–16 × 7–10μ and macrosporae with them 16–25 × 7 11μ. Dennis 50A evidently falls in the former series but does not fit any of the Malayan varieties. It differs from the type in the yellow pileus.

Hygrophorus firmus *Berk. et Br.* var. **purpureus** *Dennis* var. nov.

A typo differt pileo purpureo.

Ad terram in silvis, Naranja, Trinidad, *Dennis* 111, Typus.

Pileus 1·5 cm. convex, becoming umbilicate, silky-shining, dry, burnt lake ; flesh very hygrophanous, thin, that of the pileus staining paper with dark purple juice ; gills subdistant, adnato-decurrent, 2 mm. wide, indian red ; stipe equal, smooth, shading from pinkish-vinaceous at the apex through Naples yellow to an ochraceous-buff base, hollow. Basidia dimorphous, 4-spored, the larger 40 × 11μ, with spores 12–14 × 8μ, the smaller 30 × 5–6μ with spores 5–9 × 3–5μ no cystidia, gill trama of parallel hyphae, pileus surface of thin-walled hyphae the cells 230–270 × 20μ, filled with dark purple sap. Fig. 12.

Collection seen :—Trinidad, at 2000′ on bare gravelly soil, Naranja, 2.X.1949, Dennis 111 (Typus). Differs from the type in the purple pileus.

Corner has a variety *amethystinus* in Malaya but it belongs to the macrosporous series.

Literature cited.

Baker, R. E. D. & Dale, W. T. 1951. Comm. mycol. Inst. mycol. Pap. 33.

Lange, J. Flora Agaricina Danica Vol. 5.

Singer, R. 1952. Lilloa, 23 pp., 147–246.

Smith, A. H. & Hesler, L. R. 1942. Lloydia 5 pp. 1–94.

Bananas.*—This book on the bananas of Madras State supplies a wealth of information on the many different varieties of banana (over 70) that are known to be cultivated or to exist there. The author, formerly of the Madras Agricultural Service, spent the last fifteen years of his service engaged in a survey and study of the banana varieties of southern India.

The greater part of the book consists of separate detailed descriptions of the different varieties. These descriptions include notes on the edible and keeping qualities of the fruit, cropping and growth characteristics and other matters of economic interest. The wild species of *Musa* are also dealt with. The full page photographs of the individual plant in fruit that accompany the descriptions of most of the varieties are a valuable feature of the book and serve to give impressions that could hardly be supplied by the written word. Agriculturalists and botanists in India should find the classified lists of common or colloquial names of great service, possibly also the artificial key to the varieties which the author has drawn up. As some of the varieties cultivated in Madras are well known in other countries the book should be of interest and of use outside India.

Other sections of the book deal with the history of the banana in India, the characteristics of the banana plant, abnormalities, cultural practices, the economics of banana cultivation, and pests and diseases. An appendix giving the chemical analysis of the ripe and unripe fruits of the different varieties is another most useful feature of the book.

The author is to be complimented on the immense amount of labour he has obviously devoted to his subject and for so enthusiastically recording his many valuable observations on what is one of the most important food crops of his country. It is to be hoped that similar works will appear for other Asiatic countries where the banana is extensively cultivated and exists in a similar multiplicity of forms.

F. N. Howes.

*Madras Bananas, a Monograph, by K. Cherian Jacob. Pp. IX + 228 ; 84 plates. Government Printer, Madras, 1952. Price 7 rupees 6 annas.

NOTES ON ASIATIC GRASSES : XII

New Species

N. L. Bor

Agrostis himalayana *Bor*, sp. nov. [illegible] Griseb. comparanda, sed ab ea glumis aequilongis, ligula longiore recedit.

Gramen perenne. *Culmi* usque 50 cm. alti, plerumque breviores, teretes, laeves, glabri, striati, nodis superioribus intra partem mediam stati. *Folia* laeva, flaccidulae, lineare-acutae vel acuminatae, supra laeves glabraeque, subtus nervis scaberulae, basi rotundatae, marginibus minute scaberulae; *vaginae* culmos complectentes, inferiores scariosae, superiores virides, striatae, glabrae, scabrae. *Ligula* 3–4 mm. longa, membranacea, alba vel brunnea, in apicem acutum vel rotundatum attenuata, extus scabra.

Panicula usque 8·5 cm. longa, 3 cm. lata, plerumque brevior angustiorque, ramis binis vel singulis, ascendentes, rare patentes; axis glaber, laevis, teres, capillaris. *Spiculae* 1·1·2 mm. longae, a latere visae ellipsoideo-acutae vel lanceolato-acutae, purpureae vel viride-purpureae. *Glumae* aequales, 1-nerves, 1·1·2 mm. longae, explanatae ellipsoideo-acutae vel lanceolato-acutae, carinatae, carina scaberulae, ceterum laeves glabraeque. *Lemma* explanatum late ellipsoideo-truncatum, 1 mm. longum, callo glabrum, 3-nerve, margine superiore denticulatum laeve glabrumque, exaristatum; *palea* minutissima, hyalina, *ovar* 2; *stigmata* plumosa, *stamina* 3, *antherae* 0·4 mm. longae, purpureae.

Assam : Balipara Frontier Tract, Nyukmadung, 2000 m., 28 May, 1935, *F. Kingdon-Ward* 11538 (*typus* in Herb. B.M.); ibidem, Poshing La, 21 Jul. 1938, *Kingdon-Ward* 13988; ibidem, Orka La, Bhutan Frontier, ± 3000 m., 17 Jun. 1938, *Kingdon-Ward*.

Sikkim : 14 Oct. 1868, *Sulpiz Kurz* s.n.

Agrostis poluninii *Bor*, sp. nov. ab omnibus aliis speciebus indicis glumis maequalibus, gluma superiore longe acuminata distincta.

Gramen annuum. *Culmi* gracillimi, usque 50 cm. alti, laeves, glabri, nitentes, striati, nodis glabri. *Folia caulina* usque 15 cm. longae, 2·5 mm. latae, lineare acuminatae, utrinque glabrae, marginibus scabrae; *vaginae* internodiis breviores, basi culmorum laxae, superne complectentes, nitentes, laeves glabraeque, striatae; *ligula* membranacea, acuta, 3·5–4 mm. longa.

Panicula laxissima, usque 13 cm. longa; axis laevis, capillaris; rami bini, usque 6 cm. longi, parte inferiori nudi, ramosi, capillares, laeves glabrique vel pedicellis scaberuli. *Spiculae* 3–3·5 mm. longae, anthesi valde hiantes. *Gluma superior* 1·5–2·5 mm. longa, explanata lanceolato-acuta, 1-nervis, dorso laevis glabraque, apicem versus carina scaberula; *gluma inferior* explanata lanceolato-acuminata, 3–3·5 mm. longa, dorso laevis glabraque, carina apicem versus scabra. *Lemma* 1·5 mm. longum, 1 mm. latum, hyalinum, laeve glabrumque, late ellipsoideo-truncatum, 5-nerve; nervus medianus ex dorsi centro in aristam 3·5 mm. longam percurrens; *palea* nulla; *stamina* 3; *antherae* 0·5–0·75 mm. longae; *ovar* 2; *stigmata* brevia, plumosa.

Ind. Or. : Nepal, Brangechen Kharka, 5000 m., Aug. 1949, *O. Polunin* 1718 : birchwood in shade (typus in Herb. B.M.).

This exceedingly delicate species is quite distinct from any of the Indian species so far described. The widely gaping spikelets, the very unequal glumes and the long acuminate upper glume in particular, separate it quite easily.

Colpodium tibeticum *Bor*, sp. nov., *C. wallichii* (Hook. f.) Bor* proxima sed spiculis multo majoribus satis recedit.

Gramen perenne. *Culmi* erecti, usque 21 cm. alti, 2–3-nodes, usque paniculam vaginis tecti, laeves glabrique, striati, nodis glabri. *Foliorum laminae* complicatae vel inferiores planae, crassae, erectae, usque 7 cm. longae, 4 mm. latae, utrimque glabrae laevesque, valde-nerves, lineares, in apicem validum attenuatum, marginibus laeves vel apicem versus scaberulae ; *vaginae* inferiores breves, superiores longiores, carinatae, paulo inflatae, crassae, laeves, glabrae, striatae, laminae et vaginae junctioni purpureae ; *ligula* membranacea, lactea, 4–6 mm. longa, in apicem acutum attenuata.

Panicula oblonga vel pyramidalis, 3–7 cm. longa, 1–3 cm. lata, ramis maturitate reflexis ; rami nodis bini, 1·5 cm. longi vel breviores, basi nudi. *Spiculae* 5–6 mm. longae, cuneatae, anthesi hiantes, brevi-pedicellatae. *Gluma inferior* 5–6 mm. longa, explanata, 2 mm. lata, 1-nervis, purpurascens, marginibus hyalina, laevis, glabra ; *gluma superior* simillima. *Lemma* 4 mm. longum, explanatum 2 mm. latum, 3-nerve, oblongum, apice rotundatum, laceratum, nervorum parte inferiori aureis vel argenteis pilis tectum, superne glabrum, inferne inter nervos brevissime pilosum, purpurascens ; *palea* angusta, membranacea, 4 mm. longa, bicarinata, carinis ciliata ; *stylus* 1 ; *stigmata* plumosissima ; *stamina* 3 ; *antherae* 2·75–3 mm. longae ; *lodiculae* 2, circa 1 mm. longae, membranaceae, 1–2-dentatae.

Tibet : Cho La, north side, 4500 m., 4 Jul. 1949, *Ludlow, Sherriff & Hicks* 20796 ; Tulung La, Monyül, S. Tibet, 5500 m., 13 Jun. 1935, *F. Kingdon-Ward* 11688 (typus in Herb. B.M.).

Puccinellia kashmiriana *Bor* sp. nov., panicula stricta, ramis brevissimis, lemmatibus omnino glabris distincta.

Gramen perenne, caespitosum, radicibus multis fibrosis. *Culmi* usque 15 cm. alti, ex vagina superiore longe exserti, infra paniculam scaberuli, glabri, inferne laeves, plerumque 2-nodes, basi vaginis vetustis tecti, nodis glabri. *Foliorum laminae* superiores brevissimae, angustae, usque 2 cm. longae, 1·5 mm. latae, lineares, in apicem obtusum attenuatae, planae, saepe complicatae, utrimque marginibusque scabrae ; laminae foliorum vaginarum basalium usque 5 cm. longae, planae, molles, flaccidae ; *vaginae* laxiusculae, laminis longiores, laeves, glabrae, marginibus hyalinae, inferiores translucentes ; *ligulae* membranaceae, 1–1·5 mm. longae, laceratae.

Panicula stricta, usque 3·5 cm. longa, 5 mm. lata ; rami bini, brevissimi, usque 1·3 cm. longi, adscendentes, laeves, glabri, basi nudi et 1–2

*__Colpodium wallichii__ (*Hook. f.*) *Bor*, comb. nov. Syn. *Catabrosa wallichii* Hook. f., Flor. Brit. Ind. **7,** 312 (1896).

spiculas gerentes ; rhachis laevis, glabra, angulata. *Spiculae* 5 mm. longae, 2–3-florae, oblongo-ellipticae ; flores anthesi patentes. *Gluma inferior* 1·25–1·5 mm. longa, 0·8 mm. lata, elliptica vel oblonga, 1-nervis, marginibus anguste hyalina, omnino laevis glabraque, purpurascens ; *gluma superior* 2–2·5 mm. long, 1·2 mm. lata, oblongo-acuta vel elliptico-acuta, 3-nervis, marginibus hyalina, laevis glabraque, purpurascens. *Lemma* 3·25–3·5 mm. longum, explanatum 2 mm. latum, 5-nerve, late elliptico-acutum vel oblongo-acutum, apice compressum, apiculatum, marginibus hyalinum, purpurascens, dorso rotundatum, omnino glabrum laeveque ; *rhachilla* laevis glabraque, ejus articuli circa 1 mm. longi ; *stamina* 3 ; *antherae* 0·6–1 mm. longae ; *palea* 3 mm. longa, linearis, carinis laevis ; *caryopsis* 2 mm. longa ; *hilum* breve, lineare.

Ind. Or. : Kashmir, Kamri Valley near Kalapani, 3500–3700 m., 25 Aug. 1893, *J. F. Duthie* 12543 (typus in Herb. Kew.) ; Lahul, Bara Lacha La, 5000 m., Jul. 1941, *N. L. Bor* 16360.

Poa spontanea *Bor*, sp. nov., foliorum laminis viridissimis longe attenuatis, panicula laxissima, lemmatibus inferne brevissime pilosis distincta.

Gramen altum, perenne, rhizomatosum. *Culmi* usque 10 cm. alti, 7-nodes, teretes, laeves glabrique, striati, haud ramosi, nodis superioribus glabri, nodis inferioribus pubescentes. *Foliorum laminae* lineares, longissime acuminatae, basi rotundatae, viridissimae, supra pilis brevioribus nitentibus instructae, marginibus laeves, apicem versus nervo mediano scabrae, usque 20 cm. longae, 7 mm. latae ; *vaginae* laxiusculae, internodiis breviores, striatae, marginibus haud hyalinae, vaginae inferiores inferne breve pubescentes, vaginae superiores laeves glabraeque ; *ligula* 4–5 mm. longa, membranacea, rotundata.

Panicula laxa, late patens, 20 cm. longa, 16 cm. lata, e vagina summa exserta ; axis laevis, glaber ; nodi 5, 4, 3, 3, 2 cm. longi ; rami inferni nudi, pauce spiculati, usque 8 cm. longi, flexuosi, laeves glabrique ; inferiores 4-nati. *Spiculae* circa 5·5 mm. longae, 3–4-flores. *Gluma inferior* 2·5–2·75 mm. longa, linearis, acuta, 1-nervis, laevis, glabra, marginibus hyalina, dorso curvata ; *gluma superior* 3·5–4 mm. longa, explanata oblongo-acuta, marginibus hyalina, 3-nervis, dorso curvata, laevis, glabra. *Lemma* 3·5–4 mm. longum, explanatum 2 mm. latum, inconspicue 5-nerve, inferne carina ciliatum, inter nervos basi brevissime pilosum, marginibus apicem versus hyalinum ; *palea* lemmati aequilonga, anguste linearis, bicarinata, carinis scabra ; *stamina* 3 ; *antherae* 2·5 mm. longae ; *styli* 2 ; *stigmata* plumosa ; *rhachilla* pilosa ; *lana* adest.

Burma : Nam Tamai Valley (Ka Karpo Razi) 4–4500 m., 7 Oct. 1937, *F. Kingdon-Ward* 13379—a more or less gregarious species, one of the first flowering plants to colonize the granite rubble chutes at the base of the cliffs (typus in Herb. B.M.).

A very distinct species with a stout stem and very coriaceous leaves. From its facies one would suspect it of being a forest grass.

Hierochloe tibetica *Bor*, sp. nov., *H. laxae* Hook. f. comparanda sed ab ea panicula congesta, lemmate inferiore exaristato, lemmate secundo brevissime aristato satis recedit.

Gramen perenne, rhizomatosum. *Culmi* usque 18 cm. alti, gracillimi, teretes, striati, laeves glabrique, nodis glabri. *Foliorum laminae* ; eae innovationum usque 5 cm. longae, 2 mm. latae, lineare-acutae, planae vel involutae, utrimque laeves glabraeque ; culmorum breviores 2·5 cm. longae, 4–5 mm. latae, late lanceolato-acutae, marginibus minutissimae scabrae ; *vaginae* paulo inflatae, laeves, glabrae, striatae, inferiores scariosae ; *ligulae* membranaceae, truncatae, 2–2·5 mm. longae.

Panicula parva, densa, usque 2·5 cm. longa, 1 cm. lata, 10-spiculata ; axis, rami pedicellique capillares, flexuosi, laeves glabrique, axillis pubescentes ; *spiculae* 5 mm. longae, ambitu elliptico-truncatae vel cuneatae, purpurascentes. *Glumae* spiculae fere aequilongae (inferior paulo brevior) explanatae elliptico-acutae, 5 mm. longae, 2·5 mm. latae, 3-nerves, laeves, glabrae, carina curvatae, apicibus hyalinae, ceterum purpureae. *Anthoecium inferius* ♂ ; *lemma* 4 mm. longum, 2·5 mm. latum, oblongo-obtusum, dorso capillis brevibus aureis tectum, enerve, exaristatum, apice bilobata ; *palea* oblonga, bicarinata, bifida, apice, breve pilosa ; *stamina* 3 ; *antherae* 1·25 mm. longae. *Anthoecium secundum* ♂ ; *lemma* ad mediam partem fissum, e sinu aristam brevem 3 mm. longam exserens, ceterum inferiori simillimum ; *palea staminaque* eis anthoecii inferioris similes. *Anthoecium superius* ♀ ; *lemma* 2·5 mm. longum, 2 mm. latum, oblongo-ellipticum, rotundatum vel apice apiculatum, dorso in parte tertia superiore pilis brevibus aureis tectum, ceterum glabrum ; *styli* 2, distincti ; *stigmata* plumosa ; *stamina* 2 ; *antherae* 1 mm. longae.

Tibet : Kongbo Province, Pero La, 5000 m., 19 Jul. 1935, *Ludlow, Sherriff and Taylor* 5188. " On exposed summit ridge above pass. Stem dark purple. Glumes purple" (typus in Herb. B.M.).

Oryzopsis stewartiana *Bor*, sp. nov. spiculis parvis pallidis, laminis foliorum glaucis, planis distinguenda.

Gramen perenne. *Culmi* usque 40 cm. alti, laeves glabrique, striati, haud ramosi, nodis glabri. *Foliorum laminae* anguste lineares, planae interdum involutae, in apicem validum attenuatae, usque 13 cm. longae, 2·5 mm. latae, supra glaucae, infra virides, utrinque scaberulae vel infra laeves, marginibus scaberulae, apicem versus scaberrimae, basi rotundatae ; *vaginae* superne complectentes, inferne basi a culmis solutae, striatissimae, laeves glabraeque, internodiis breviores ; *ligula* membranacea, 2–2·5 mm. longa, apice rotundata.

Panicula laxa, usque 14 cm. longa, 1–2 cm. lata ; axis capillaris, angulatus, plus minusve scaber ; rami breves, gracillimi, scaberuli, basi nudi, apicibus paucas spiculas gerentes. *Spiculae* 4–4·5 mm. longae, pedicellatae ; pedicellus gracilis, glaber, spiculam infra clavatus. *Gluma inferior* 4–4·5 mm. longa, elliptico-acuminata, 2 mm. lata, 5-nervis, laevis, glabra, pallidissima apicibus purpureis ; nervi laterales brevissimi, evanescentes ; *gluma superior* glumae inferiori similis, aequilonga, 3-nervis. *Lemma* 3 mm. longum, anguste oblongo-lanceolato-acutum, pallide aureum (demum brunneo-nigrum ?), dorso lateribusque pilis brevibus sericeis obtectum, lateraliter rotundatum et paleam complectens ; *palea* similis sed brevior angustaque ; *styli* 2 ; *stigmata* plumosa ; *stamina* 3 ; *antherae* 1·5 mm. apicibus ciliatae ; *lodiculae* 2, tenues, hyalinae, lanceolato-acutae ; *caryopsis* non visa.

Ind. Or. : Pulga, Parbatti Valley, 2000 m., 22 Jul. 1935, *Mohinder Nath* 988 (typus in Herb. Kew.).

Digitaria duthieana *Henr.*, sp. nov. *D. microbachne* (Presl) Henr. comparanda sed ab ea racemis multo brevioribus, gluma superiore enerve, ciliata minutissima recedit.

Gramen perenne, caespitosum, stoloniferum, basi cataphyllis sericeo-lanatis obtectum. *Culmi* basi decumbentes, demum erecti, nodis radicantes, usque 20 cm. alti, laeves, glabri, teretes, e vagina summa longe exserti. *Foliorum laminae* 2·5–5 cm. longae, 2·5–3 mm. latae, lineari-acutae, basi rotundatae, marginibus scabrae, basi sparse pilis longis e tuberculis ortis instructae, utrinque sparse pilosae scaberulaeque ; *vaginae* basi culmorum hirsutae, laxiusculae, marginibus hyalinae, superne glabrescentes ; *ligula* ad seriem pilorum densorum 1 mm. longorum redacta.

Racemi bini (rarissime terni) 2·5–3 cm. longi, erecti demum divergentes ; rhachis anguste alata, marginibus scabra, 0·75 mm. lata. *Spiculae* pedicellatae, binae, 2·5 mm. longae, 0·75 mm. latae, elliptico-acutae. *Glume inferior* nulla ; *gluma superior* minuta, triangularis vel orbicularis, apice rotundata, 0·3 mm. longa, marginibus longe ciliata. *Anthoecium inferius* vacuum ; *lemma* coriaceum, elliptico-acutum, 2·5 mm. longum, 0·75 mm. latum, glabrum, 5-nerve, marginibus brevissime pilosum ; *palea* nulla. *Anthoecium superius* ♀ ; *lemma* anguste elliptico-acutum, glaberrimum, striatum, pallido-lividum, laeve ; *palea* pallidior, marginibus lateralibus latioribus ; *stamina* 3 ; *antherae* 1 mm. longae, lineares, luteae (?) ; *styli* 2 ; *stigmata* plumosa.

Ind. Or. : Bandelkhand, Barwar Sagor, near Jhansi, 9 Dec. 1886, *J. F. Duthie* s.n. (typus in Herb. Kew.).

This species appears, with a short English description in Henrard, *Monograph of the Genus Digitaria*, 944 (1950). A Latin description and diagnosis are now provided in order to validate the name.

Miscanthus taylorii *Bor*, sp. nov. ab omnibus speciebus hujus generis adhuc descriptis spiculae longi-pedicellatae gluma inferiore acuta, spiculae brevi-pedicellatae gluma inferiore truncata distinguenda.

Gramen perenne, basi squamis elaminatis coriaceis tectum, radicibus fibrosis. *Culmi* usque 90 cm. alti, teretes, ad basim glabri laevesque sed infra paniculam pilis longis albis pilosi, striati, nodis glabri. *Foliorum laminae* usque 45 cm. longae, 6 mm. latae, utrimque sparse pilis albis longis e tuberculis ortis tectae, nervo mediano lato albo, virides, subtus pallidiores, lineari-acuminatae, flaccidiusculae ; *ligula* membranacea, 1·5 mm. longa, margine ciliata, extus pilosa.

Panicula 13 cm. longa, 11 cm. lata, flabelliformis, effusa, laxiuscula ; axis communis angulatus, planus, sparse pilosus ; rhachis racemorum 5 cm. longa, inarticulata, angulata. *Spiculae* 5·5 mm. longae ad quemvis rhacheos nodum binae, primaria longius, secundaria brevius pedicellata, demum a pedicellis solutae ; pedicelli longi 5–9 mm. longi, breves 3–5 mm. longi, margine pilis purpureis 2–5·5 mm. longis pilosi. *Spicula longe-pedicellata* ; *gluma inferior* 5 mm. longa, explanata 1·5–1·75 mm. lata, lanceolato-acuta vel elliptico-oblongo-acuta, 5-nervis, coriacea,

inter nervos laterales paulo convexa ; *gluma superior* chartacea, 5 mm. longa, explanata 1·75 mm. lata, elliptico-acuta, 3-nervis, laevis, glabra, marginibus apicem versus ciliata, mucronata. *Anthoecium* inferius vacuum ; *lemma* 5·5 mm. longum, superne ciliatum, lanceolato-acutum, lateribus hyalinum, ceterum membranaceum ; *palea* nulla. *Anthoecium superius* ♀ ; *lemma* 4·5 mm. longum, lanceolato-acutum, hyalinum, nervus medianus ex apice in aristam planam validam, paulo tortam, 4–5 mm. longam, percurrens ; *palea* hyalina, 3 mm. longa, apice longe ciliata ; *styli* 2 ; *stigmata* obscura ; *stamina* 2 ; *antherae* 3 mm. longae ; *lodiculae* 2, cuneatae. *Spicula breve-pedicellata* ; *gluma inferior* chartacea, elliptico-oblongo-truncata 4 mm. longa, 2-carinata, inter carinas concava, margine superiore truncata, ciliata, dorso glabra laevisque, lateribus apicem versus pilis longis albis instructa ; *gluma superior* et ceterae partes eis spiculae longe pedicellatae simillimae.

Tibet : Kongbo Province, Trim La, Mayër, 3500 m., 9 Jul. 1938, *Ludlow, Sherriff & Taylor* 5799—Common in open swampy meadows (typus in Herb. B.M.).

Miscanthus wardii *Bor*, sp. nov., *M. nudipedi* Hack. comparanda sed ab eo spiculae gluma inferiore glabra, apice late truncata recedit.

Gramen perenne, erectum, squamis basalibus coriaceis obtectum. *Culmi* usque 1 m. alti, erecti, teretes, striati, laeves, glabri vel rarissime infra paniculam sparse pilosi, nodis glabri. *Foliorum laminae* lineares, in apicem acuminatum attenuatae, basi rotundatae, usque 50 cm. longae, 7–10 mm. latae, marginibus scaberrimae, utrinque pilis albis e tuberculis ortis sparse vel sparsissime tectae, glauciusculae ; *vaginae* basim culmi versus laxae a culmis solutae, superne culmos amplectentes, media parte superiore glabrae, media parte inferiore pilis albis e tuberculis ortis dense tectae, striatae ; *ligulae* 1–1·5 mm. longae, membranaceae, rotundatae, margine superiore laceratae.

Panicula 8–12 cm. longa ; racemi fasciculati, 8–12 cm. longi ; rhachis inarticulata, laevis, glabra, subteres ; internodia 3·5–5 mm. longa. *Spiculae* 5 mm. longae, pedicellatae, binae ad quemvis rhacheos nodum, primaria longius pedicellata, secundaria brevius pedicellata, demum a pedicellis solutae ; pedicellus longus 3–4 mm. longus, brevis 1–2 mm. longus, laevis, glaber, margine superiore pilis 5 mm. longis purpureis ciliatus. *Gluma inferior* 3·5 mm. longa, explanata 1·25 mm. lata, elliptico-truncata, purpurascens, 6-nervis ; *gluma superior* 4–4·5 mm. longa, explanata 1·5 mm. lata, ovato-oblonga, apice irregulariter truncata, 3-nervis, laevis, glabra, dorso rotundata, nervis lateralibus cum nervo mediano infra apicem anastomosantibus. *Anthoecium inferius* vacuum ; *lemma* hyalinum, oblongum, acutum, 3·5–4·5 mm. longum ; *palea* nulla. *Anthoecium superius* ♀ ; *lemma* 3–4·5 mm. longum, lanceolatum, 1-nerve, laeve, glabrum ; *palea* circa 2 mm. longa, hyalina, oblonga-acuta ; *arista* 11 mm. longa, flexuosa, basi paulo torta ; *stamina* 3 ; *antherae* 2·75 mm. longa ; *styli* 2 ; *stigmata* plumosa ; hilum basale, punctiforme.

Ind. Or. : Assam, Di Chu Gorge, Lohit valley, 18 Jul. 1950, 1500 m., *F. Kingdon-Ward* 20091—forms large tufts usually on the banks of streams or torrents in full sun ; ibidem, 24 Jul. 1950, *F. Kingdon-Ward* 20095—a single clump in half shade growing close to Di Chu ; ibidem, 12 Apr.

1950, *F. Kingdon-Ward* 19328—a big tufted grass on the stony terraces and among boulders in the torrent bed (typus in Herb. Kew.) ; Mishmi Hills, ex Herb. *Griffith* no. 32.

Cymbopogon tibeticus *Bor* sp. nov., *C. hookeri* (Munro) Stapf proxima sed spiculis minoribus, panicula simplice, culmis multo minoribus, racemorum pedunculis multo brevioribus distincta.

Gramen perenne basi multis scariosis vaginis dilute luteis obtectum. *Culmi* usque 45 cm. alti, glaberrimi, teretes, nitentes. *Foliorum laminae* plerumque ex vaginis basalibus, angustae, lineares, in apicem longum filiformem attenuatae, supra pilis longis albis obsitae, plerumque complicatae, raro planae, supra marginibusque scabrae ; *vaginae* internodiis breviores, glabrae laevesque, inferiores brevissimae ; *ligulae* laceratae, membranaceae, 3 mm. longae.

Racemi subcompositi in apice culmi ramorumque gemini, vaginis spathiformibus fulti ; spathae angustae, cymbiformes, acuminatae, 2·5 cm. longae, laeves glabraeque, rubescentes ; racemi demum haud epinastici, inaequales, 4-nodes, alter sessilis basi spicula sessile ♂ cum spicula pedicellata ♂ fultus, uter pedicellatus spicula sessile ♀ cum spicula pedicellata ♂ fultus, 5-nodis ; articuli 3 mm. longi, clavati, marginibus ciliati, ambabus superficiebus pilis obsiti, truncati, apice bidenticulati ; spiculae pedicellatae ; pedicellus 1·75 mm. longus, apice concavus et truncatus, duobus dentibus armatus, sectioni plano-convexus, ambobus marginibus ciliatus pilis superne longioribus. *Spicula inferior sessilis* ; *gluma inferior* (cum callo magno 1 mm. longo) 4–5 mm. longa, lanceolato-oblonga, in apicem truncatulum attenuata, bicarinata, inter carinas profunde sulcata, superne carinis scabra, marginibus hyalinis inflexa ; *gluma superior* 4–5 mm. longa, apice carinata, navicularis, carina scabra, ceterum glabra, chartacea. *Anthoecium inferius* vacuum ; *lemma* hyalinum, 4·8 mm. longum, fere bicarinatum ; *palea* nulla. *Anthoecium superius* ♂ ; *lemma* 2 mm. longum, lanceolato-acutum, apice aristam vestigialem gerens ; *palea* hyalina, triangularis, 1 mm. longa ; *stamina* 3 ; *antherae* 2·5 mm. longae, fusco-purpureae. *Racemi spicula sessilis* ; *gluma inferior*, *gluma superior*, *lemma* et *palea* eis spiculae sessilis inferioris similes ; *lemma superius* lanceolato-oblongum, apice bilobatum, aristam 8 mm. longam e fissura emittens. *Spicula pedicellata* lanceolato-acuta, 5 mm. longa ; *gluma inferior* lanceolato-acuta 5 mm. longa, bicarinata, carinis scabra, dorso plana vel convexa, 7-nervis ; *gluma superior* aequilonga, navicularis, dorso rotundata, apicem versus carinata, superne carina scabra, ceterum glabra. *Anthoecium inferius* vacuum ; *lemma* lanceolato-acutum, brevius quam spiculam, 2-nervis, marginibus hyalinis flosculum complectentibus ; *palea* nulla. *Anthoecium superius* ♀ ; *lemma* hyalinum, 2 mm. longum, nonnumquam fere usque basin fissum ; *palea* triangularis, hyalina, 0·5–1 mm. longa ; *stamina* 3 ; *antherae* 2·5 mm. longae.

Tibet : Kyichu valley, 15 miles east of Lhasa, 3000 m., Aug. 1904, *H. J. Walton* s.n. ; typus in Herb. Kew. ; Tsangpo valley, 19 Jul. 1935, 3000–3300 m., *F. Kingdon-Ward* 12022—grass which grows in the sand helping to bind it and forms turf in which flowers grow ; Kongbo Province, Kyikar, 27 Jul. 1938, 3000 m., *Ludlow, Sherriff & Taylor* 5446—

on rocks—glumes purple, styles dark purple ; Vicinity of Lhasa, 3000 m., Jul. 1939, *H. E. Richardson* 273 ; Hills south of Lhasa, 4000 m., 11 Jul. 1943, *Ludlow & Sherriff* 9745—on sandy open grassland.

Poa pseudamoena *Bor* nom. nov., Syn. *P. amoena* Bor in Kew Bull. **1948,** 140 (1948) non (Presl) Kunth, Enum. Plant. **I**, 342 (1833).

Phylogeny and Morphogenesis.*—Terms come and terms go. Apparently " morphogenesis ", the process of development of the individual, is now preferred to " ontogeny ". Problems widen and deepen and many of those known to previous generations of botanists still await more than very partial answers. The volume of botanical literature grows apace and the dangers of increasing specialization are often apparent. There is, therefore, justification for the publication of accounts that are in essence essay reviews covering a field intermediate between the necessarily superficial treatment of a " text-book " and the limited and specialized summary often essential to give proper perspective to newly published research. Professor Wardlaw's book comes in this category.

Few recently written books within the realm of botany meant for wide general reading can more deserve the term " meaty ". It covers an enormous range of subjects more or less linked to the study of plant form. A great deal of recent research is summarized—the bibliography occupies over forty pages—and at times the reader feels rather overwhelmed by the number of viewpoints presented to him.

Naturally, the Pteridophyta are given some prominence and the chapters dealing with experimental morphology are amongst the most interesting and most valuable in the book. However, it can be fairly pointed out that a judicious balance is kept between the different aspects. One must especially appreciate the desire to keep genetical viewpoints constantly to the fore. " Broadly speaking, it may be accepted that genes control development. How and in what circumstances they do so is one of the major problems of biology, but one of which we have at best only the most sketchy notions " (p. 108). Again, " That the effect of the hereditary constitution permeates every aspect of development from the zygote to the adult state is a truth that sooner or later becomes evident to all who study morphogenesis " (p. 303).

Amongst the many other matters dealt with in these pages one can only mention the origin of the leafy shoot, the origin of a land flora, biochemistry and morphogenesis (including phytohormones), the form and the formation of roots, buds and flowers, and physical factors and morphogenesis. The penultimate chapter on " theories of organisation in plants " raises questions of philosophical biology while the final attempt " Towards a synthesis " perhaps achieves its object if it leaves one " with an open mind, and a due suspension of judgment."

W. B. Turrill.

*C. W. Wardlaw, Phylogeny and Morphogenesis, Macmillan & Co., Ltd., 1952, pp. 536, figs. 173, 42/-.

SPHAGNUM CAPILLACEUM (WEISS) SCHRANK

JANE TAYLOR

The identification of the species of *Sphagnum* described before the introduction of modern diagnostic methods presents peculiar difficulties, especially where no type material has been preserved. In such cases the application of names must be by inference and agreement, aided by such items in the original descriptions as may be relevant, particularly while 1753 remains the starting point of *Sphagnum* nomenclature.

At the present time the name *Sphagnum nemoreum* Scop. and *S.capillaceum* (Weiss) Schrank are in current use by European and American bryologists respectively for the same plant—*S. acutifolium* auctt., and it is necessary to re-examine the available data in order to reconcile the two views. As a result of such an examination the writer has concluded that the name which best applies is *S. capillaceum* (Weiss) Schrank.

Richards and Wallace (1950) adopted the name *S. nemoreum* Scop. (1772), the type of which has not, apparently, survived, following the argument of Du Rietz (1945), who based his conclusion on the work of Lindberg (1882) and Dusén (1887)—". . . . as shown by Lindberg and Dusén the name *S. nemoreum* is undoubtedly the oldest name of the *S. acutifolium* of later authors." (from the Swedish). *S. acutifolium* Ehrh. (1788) however must be regarded as a *nomen confusum*. Du Rietz (1945) says, and there is no reason to doubt his evidence, " . . . . *S. acutifolium* in the exsiccatae of Ehrhart is *S. fimbriatum* in the Uppsala Herbarium, and in the Berlin Herbarium according to Warnstorf partly *S. fimbriatum* partly *S. plumulosum* " (from the Swedish).

Lindberg (1882) and Dusén (1887) in support of *nemoreum* based their conclusions solely on conjecture. The former eliminated various species which do not grow, he believes, under conditions mentioned ; the latter concluded that everything but ' *S. acutifolium* ' and *S. girgensohnii* Russ. were excluded. Dusén (1887) consulted Lindberg, who wrote to Breidler, who was acquainted with the general region where Scopoli collected. Both *S. girgensohnii* and ' *S. acutifolium* ' grew in the region but the latter was found in fruit and Scopoli described fruit. *S. girgensohnii* does not commonly fruit so Breidler and the others were persuaded that Scopoli must have had ' *S. acutifolium* '—one can only consider the evidence as circumstantial, and *S. nemoreum* Scop. as a *nomen dubium*.

Lindberg (1883) was able to examine the *Sphagnum palustre* var. β* of Linné, which furnishes a definite specimen in the Dillenian Herbarium at Oxford. He found that it is the ' *S. acutifolium* ' of later authors. The " B " became *capillaceum* when Weiss (1770) provided a varietal epithet and Schrank (1789) raised it to specific rank. Dr. Le Roy Andrews (personal communication) in co-operation with Dr. Barnhardt selected *capillaceum* for the above reason. UNFORTUNATELY in the meantime Hedwig (1782) had adopted the name *S. capillifolium*, the epithet having

*In the Dillenian Herbarium, ' B '—*Sphagnum palustre molle deflexum squamis capillaceis* is represented by four specimens of which the one annotated 4 is named as a variety by Dillenius and can be ruled out. Of the remaining three 1 and 2 are conspecific and have been given the same name by both Lindberg and Garnsey while specimen 2 appears to be the one figured by Dillenius. It may therefore be regarded as the type of *S. capillaceum* (Weiss) Schrank.

been used by Ehrhart (1780) for the variety. Under the rules Ehrhart's epithet was illegitimate for the variety, but Hedwig was by no means obliged to adopt the *capillaceum* of Weiss and was at liberty to choose any available specific epithet when he raised the variety to specific rank. Hedwig's *capillifolium* however must be regarded as a *nomen nudum*.

In the light of present research there is little doubt as to the desirability of using the name *S. capillaceum* (Weiss) Schrank.

I wish to acknowledge much help from Dr. A. Le Roy Andrews who expressed disapproval of my use of the name *S. nemoreum* Scop. and so stimulated further inquiry.

For valuable discussion I am indebted to Mr. F. Ballard, Mr. A. A. Bullock, Prof. P. W. Richards and Mr. E. C. Wallace. I acknowledge the help of Dr. E. F. Warburg in consulting the Dillenian Herbarium and thank Dr. O. Hedberg and Mr. W. C. Worsdell for translations from Swedish and other literature.

References.

Du Rietz, G. E. (1945). Några namnfragor inom släktet Sphagnum. Svensk Bot. Tidskr. 39. 151–152.

Dusén, K. F. (1887). Om Sphagnaceernas Utbredning i Skandinavien 30–33.

Ehrhart, F. (1780). Hannov. Mag., 15. 235.

—— (1788). Pl. crypt., dec, 8 n. 72.

Hedwig, J. (1782). Fundamentum Historiae Naturalis 2, 86.

Lindberg, S. O. (1882). Europas och Nord Amerikas Hvitmossor (Sphagna) 52–57.

—— (1883). Kritisk Granskning af mossorna uti Dillenii Historia muscorum 56.

Richards, P. W. and E. C. Wallace (1950). An annoted List of British Mosses. Trans. Brit. Bry. Soc. 1 Pt., 4.111, XXIX.

Schrank, F. von P. (1789). Baiersche Flora 2. 345.

Scopoli, I. A. (1770). Pl. Crypt. Gott. 265.

BIBLIOGRAPHICAL NOTES. I.

H. S. Marshall

1. The Date of Publication of F. M. Bailey's Comprehensive Catalogue of Queensland Plants.

In the *Proceedings of the Royal Society of Queensland* 61 : 105, the late C. T. White has given an excellent account of the life and work of the celebrated Australian botanist F. M. Bailey, together with a list in chronological order of his main works. Referring to the *Comprehensive Catalogue of Queensland Plants* he says (p. 112) :—

> " No date appeared on the title-page, the ' Prefatory and other Notes ' are dated 1909, but a special one prefacing Addenda and Corrigenda is dated 19th December 1912. The first few copies were received from the printer before Christmas of that year, though the general issue was not made until early 1913."

As general distribution did not take place before the early part of 1913 and despite the fact that a few copies were received from the printers (probably only by Bailey himself) it would seem reasonable to accept the date of general distribution as the date of publication, viz., the early part of 1913.

2. The John Bradbury Collection.

Under the title " Plant Collecting in Missouri : A Liverpool Expedition, 1809–11 ", H. Stansfield, the Curator of the Liverpool Museums has published in *the Liverpool Libraries, Museums & Arts Committee Bulletin* 1 : no. 2, p. 17 (October, 1951) an interesting account of the 115 unmounted specimens which form the John Bradbury Collection in the Herbarium of the City's Museums.

Reference is made in this article to the visits of Professor H. W. Rickett of New York to Britain in connection with the collection and to the results of his researches published in a paper which appeared in the Proceedings of the American Philosophical Society 1950.

Earlier, in the Kew Bulletin 1934, p. 49, Professor Rickett published a paper " Specimens collected by Bradbury in Missouri Territory " with special reference to the specimens in the Herbarium of the Royal Botanic Gardens, Kew.

The article by H. Stansfield gives many interesting items of information regarding Bradbury and his travels for the Liverpool Botanic Garden. It also includes a facsimile copy of a letter from Bradbury to William Roscoe (1753–1831), the first President of the Garden, and a map showing his journey up the Missouri river in 1811.

3. Miquel's Plantae Junghuhnianae.

A note in the Kew copy of Miquel's Plantae Junghuhnianae gives the dates of publication (taken from the original wrapper of a copy at one time in the possession of Prof. W. G. Craib) as follows :—

Fasc. 1 (pp. 1–106)	...	1851 [March]
„ 2 (pp. 107–270)	...	1852
„ 3 (pp. 271–394)	...	1854
„ 4 (pp. 395–522)	...	1855

This confirms the information supplied by F. G. Wiltshear in the *Journal of Botany* volume 52 : 44 (1914) in which he corrects a statement made by S. T. Dunn (*ibid* 51 : 358 : 1913) that fascicle 1 consisted of pp. 1–98. According to *Flora* 1851, p. 302, fascicle 1 appeared in March, 1851.

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4. Wight's Catalogue of Indian Plants.

In the preface to his Catalogue Robert Wight has given the date " 28th May 1833." It should be noted however that this date can apply only to the first 64 pages, since Dr. G. A. Walker-Arnott in a letter to Dr. Hooker dated 24 Sept. 1834 says " I beg herewith to send pp. 65 to 112 of Wight's catalogue ", which no doubt were distributed in 1834. At the foot of p. 128 appears the date " April 1836 ", from which one can deduce that pp. 113–128 were distributed in 1836. Page 144 is dated at the foot " 25 Sept. 1837 ", suggesting that pp. 129–144 appeared in 1837.

From this evidence it seems clear that the dates of publication of Wight's Catalogue are as follows :

PP. 1– 64 28th May, 1833.
PP. 65–112 24th Sept., 1834
PP. 113–128 April, 1836.
PP. 129–144 25th Sept., 1837.

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5. Zeitschrift für Botanik, vol. 39.

In July, 1950 a copy of volume 39 of the above periodical was received at Kew in a single plain paper wrapper with no indication of the dates of publication. A letter was therefore sent to the publishers who replied giving the dates of publication of this volume as follows :—

Heft 1 (pp. 1–48) Published Sept. 20, 1943.
Heft 2 (pp. 49–112) Published Dec. 20, 1943.
Heft 3–4 (pp. 113–192) Published Sept. 30, 1944.

As there may be others who have received similar copies of this volume, without dates of publication, it seems desirable that this information should be recorded here.

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6. Schumacher's 'Beskrivelse af Guineeiske Planter som ere fundne af danske Botanikere, isaer af Etatsraad Thonning'.

As some doubt exists as to whether the " separate print " of this work was actually published in 1827 as stated on the title-page it may be of interest to place on record an extract from a letter recently received from the Librarian, Botanisk Centralbibliotek, Copenhagen, in which the date of publication is confirmed in the following words :—

> " I can inform you that the paper by H. C. F. Schumacher 'Beskrivelse af Guineeiske Planter som ere fundne af danske Botanikere, isaer af Etatsraad Thonning' in fact has been issued in 1827 as a reprint, a year before it was published in *Kongl. Danske Vidensk. Selsk. Skrifter. vol. III*, 1828 *and vol. IV.* 1829."

NOTES ON TROPICAL AFRICAN TURNERACEAE

J. Lewis

In the course of the preparation of the family *Turneraceae* for the Flora of Tropical East Africa it became necessary to identify a flowering specimen collected by Mr. C. J. Pitt-Schenkel in the Usambara Mts. in 1934 which had been referred to this family by Mr. J. P. M. Brenan*. Mr. Brenan, when collecting in the same area in 1947, re-collected the same species, and analysis of his material, some of which is preserved in spirit, confirms its turneraceous nature. It is recognised also to be a species of the genus *Stapfiella* (which was placed by Gilg in the *Flacourtiaceae*) though not one previously known. The implication that this genus has been wrongly included in *Flacourtiaceae* has been confirmed, and its transfer to *Turneraceae* is proposed.

The transfer of *Stapfiella*, described by Gilg in 1913 (see below) is justified especially by the character of the seeds. These have a hard, longitudinally striated testa with a distinct raphe, are umbonate above, contracted below into the hilum, carry a membranous unilateral aril and enclose an upright straight embryo; all this being in the manner of the seeds of *Turneraceae*. Gilg's plant was presumably only in flower as his generic description does not mention the fruit or its solitary seed. The presence of many other characters common in *Turneraceae* makes its retention in *Flacourtiaceae*, though not impossible, at least illogical. Several features of the floral morphology are such, and it is notable that Gilg mentions the unusualness of the floral structure at the end of his observations on the genus. *Stapfiella* certainly includes a few characters which are not known in *Turneraceae*. These characters, however, are either equally unknown, or are rare in Flacourtiaceae, such as the basally uniovulate nature of the ovary, or may be considered now as generic characters within *Turneraceae*, such as the septicidal dehiscence of the fruit.

Dr. C. R. Metcalfe very kindly undertook an anatomical investigation of Mr. Brenan's plant, and although his report cannot be said to endorse the transfer of *Stapfiella* to *Turneraceae*, he finds no more positive affinity with *Flacourtiaceae*. He states that this is largely due to our incomplete knowledge of the anatomy of the former family and to the wide range of variation in the anatomy of the latter.

Regarding affinity with *Turneraceae*, Dr. Metcalfe notes that the unicellular hairs of *Stapfiella* are basally lignified and fairly thick walled ; similar hairs occur in *Turneraceae*. He observes that Mr. Brenan's plant lacks any crystalline inclusions in which respect it resembles the *Turneraceae*. Unfortunately he does find a number of secretory cavities which are not known in that family, and does not find any definitely tanniniferous cells which are common there. On the whole the anatomical evidence is inconclusive but I am indebted to Dr. Metcalfe for his assessment of it.

*Brenan : " Check-List of the Forest Trees & Shrubs of the British Empire, No. 5, Part II, Tanganyika Territory " (1949).

Stapfiella *Gilg*

in Mildbr. Wiss. Erg. Deutsch. Zent. -Afr. -Exp. 1907-08, II Bot. (1913), 571, ut *Flacourtiacea* descripta fuit ; hoc loco in *Turneraceas* translata est.

Descr. gen. ampl. : *Fructus* : capsula unilocularis, plus minusve anguste ellipsoidalis, ab apice ut videtur septicidaliter dehiscens ; brevissime (usque ad 0·5 mm.) rostrata. *Semen* unicum, erectum (non curvatum), apice umbonatum, testa crustacea, longitudinaliter striato-submuricata, rapha distincta, arillo unilaterali membranaceo.

Stapfiella claoxyloides *Gilg* in Mildbr., Wiss. Erg. Deutsch. Zent. -Afr. -Exp., 1907–8, II Bot. (1913) 571 ; Staner in Ann. Soc. Sci. Brux., sér. 2, **58** (1938) 106.

Holotype : Ruanda Urundi, Rugege forest, Rukarara, Aug. 1907 *Mildbraed* 920 (B. destroyed by fire).

The identity of this species was fixed for the present study by the specimen recorded by P. Staner in 1938. Permanent fixity is now proposed by the following citation of this specimen.

Neotype : Belgian Congo, Lakes Edward & Kivu District (*fide* Staner), Kabango, steppe à *Acanthus*, 3 Nov. 1914 (fl. & fr.), *Bequaert* 6174 ! (BR) :—fleurs vert-blanchatres.

Stapfiella usambarica *J. Lewis* sp. nov. ab affini *S. claoxyloidi* Gilg, pedicellis tuberculate-pubescentibus, tuberculis glandulosis intra calycem apice non libero, floribus majoribus, lobis calycis impresso glandulosis differt.

Frutex usque ad 3 m. altus. *Rami* maturi ferruginosi, aequaliter et dense grisio-pubescentes. *Folia* papyracea, alternata, petiolata, lamina plus minusve anguste elliptica, 4–11 cm. longa, 1–3 cm. lata, basi cuneata, margine serrata, dentibus aliquando glanduloso-terminatis, apice acuta, raro subacuminata ; costa supra impressa et pubescens praesertim ad basem, subtus cum nervis sparse pubescentes ; lamina inter nervos glabra vel subglabra, insuper conspicue et regulariter glandulosopunctata, punctis siccitate nigris numerosis ; petiolus usque ad 1·5 cm. longus, supra et subtus pubescens. *Bracteae* folia simulantes sed minorae autem. *Paniculae* rigidae, axilares et terminales, 4–6 cm. longae, usque c. 20-florae, in parte proxima pubescentes, in parte distali brevius pubescentes et pilis longioribus basi incrassato-tuberculatis (in vivo translucentibus viridi-albis) ; pedicelli tamen apice tantum puberuli, pilis longioribus absentibus. *Bracteae intrapanicularae* minimae vel folia simulantes sed usque ad 2 cm. longae autem. *Alabastri* maturi anthesi 5–7 mm. longi ; hypanthiis 0·25 mm. longis. *Calyx* extus infra virido-albus et puberulus, ad apices loborum albicans et aliquantum purpurascens, glaber vel subglaber ; calyx intus tuberculis glandulosis magnis quinque, plus minusve late oblongis, c. 1 mm. longis, crassis et carnosis, tota adnatis, marginibus incrassis, apice aliquando trifido nec libero nec fimbriato ; tubus 0·75–1·5 mm. longus ; lobi anguste oblongi, 3–4 mm. longi, punctis glandulosis impressis siccitate nigricantibus (luce transmissa visis) sparse, et obscure praedit. *Petala* alba usque ad 7 mm. longa (matura), fauce calycis inserta, basi nuda. *Filamenta* brevissime (0·25

FIG. 0. *Stapfiella usambarica* J. Lewis (all from Brenan 8299)—1, habit × ½ ; 2, leaf-margin × 3 ; 3, apex of fertile shoot × 1½ ; 4, flower with one " sepal " & petal removed and ovary sectioned × 8 ; 5, insertion of petals and stamen on calyx × 8 ; 6, bunch of tuberculate-based hairs on ovary × 60 ; 7, capsule × 8 ; 8, seed × 8.

mm. perigyna, infra tuberculis calycis inserta, c. 5 mm. longa, alba, glabra, in parte libera teretia; antherae introsae subquadratae, supra basin affixae, 2-cellulares. *Ovarium* oblongo-ovoideum, c. 1 × 0·5 mm., plus minusve longe pubescens et praesertim supra medium pilis longioribus basi incrassatis; styli 2–3 mm. longi, pallide sulphurei, apicibus stigmatosis fimbriatis, clare sulphureis. *Pedicelli* fructiferi arcuato-deflexi. *Capsula* anguste ellipsoidalis, 4–4·5 × 1–1·5 mm., pubescens et pilis longioribus basi incrassatis, aliquando ad basem tantum puberula, sicciate non nigri-glandulosa, obscure minus 0·5 mm., rosulata. Semen anguste oboviodeum, castaneum; arilio subpapyraceo, apice medium seminis non excidit.

TANGANYIKA. Tanga Prov., Lushoto Dist., W. Usambara Mts., Magamba Forest, in *Ocotea usambarensis-Lasianthus* sp. community*, 1900 m., 1 Oct. 1934 fl., *Pitt* [*-Schenkel*] 400 (IFI :—flowers white; and near Magamba Peak, frequent in one area of Ocotea-Podocarpus tall forest with *Memecylon dimidiatum, Rapanea, Ocotea, Lasianthus & Trichocladus*, 7 Nov. 1947 fl. & fr., *Brenan* 8299 (holotype with spirit material, K; isotypes, IFI, EA & elsewhere :—Stems up to c. 1 inch diameter, grey-brown, trailing along ground and rooting, then ascending up to 10 ft. with erect or spreading branches. Bark smooth, brownish. Young stems green with grey pubescence. Leaves papery, mid to deep glossy green above with impressed midrib and lateral nerves, pale green and somewhat glossy beneath with raised prominent whitish-green midrib and concolorous venation (with surface of lamina, lamina with many dot-like immersed glands only visible by transmitted light. Panicles rigid, not drooping. Pedicels pale green, dotted with whitish hairs which are expanded at base into a translucent greenish-white tubecle. Calyx-tube greenish-white, lobes whitish, purple-tinged above. Petals white, claw erect, lamina spreading. Filaments and anthers white, filaments inserted at the base of a yellow nectar-gland adnate to calyx-tube. Ovary green. Styles 3, pale yellow, stigmas bright yellow. Pedicels after flowering becoming sharply deflexed in relation to the inflorescence axis from which they arise. Young fruit green and deflexed, clothed below with short non-tuberculate hair, above with tubercled hairs as on pedicel. Seeds single whitish, attached at base with a short regular margined aril. Old fruits on dead inflorescences brown, dehiscing from stylar end downwards into 3 diverged valves attached at base.

This species, apparently endemic on the W. Usambara Mts., may be distinguished from the *S. dewevrei* Gilg. by the diagnosis given above. Of the other two described species, *S. ulugurica* Mildbr., which is endemic on the Ulugurus Mts., has yellow petals and a capsule which bears (at least when dry) a number of small black (glandular) patches and *S. warneae*, confined as yet to the Baguian Congo, has a panicle 5–9 cm. long with glabrous branches and larger (7–12 cm. long) bluntly & more widely serrate acuminate leaves.

Wormskioldia *Thonn.*

Wormskioldia prittwitzii *Urb.* in Fedde, Repert. Sp. Nov. **13** (1914) 152.

The holotype of this species, *von Prittwitz* 165 from Konta Mt., Myambwa, Tanganyika was in the Herbarium at Berlin Dahlem and has

*Pitt-Schenkel in J. Ecol. **26** (1938).

been destroyed. A gathering from Kondoa District, Tanganyika in Jan. 1928 by B. D. Burtt is preserved on two sheets in the Kew Herbarium. The sheets bear plants from different, although nearby, areas. B. D. Burtt compared the sheet labelled " hills SW. of Kolo " with the holotype in 1928, and it is proposed that this sheet, now numbered Burtt 1191A, should be regarded as the neotype of the species. The other sheet, conspecific but differing slightly in the notes of habit & altitude and from " hills E. of Kolo ", retains the number *Burtt* 1191.

Wormskioldia brevicaulis *Urb.* in Jahrb. K. bot. Gart. & Mus. Berl. **2,** (1883) 51. Type : Zanzibar, *Grandidier* 28 (P, holotype ! ; K, photo. & tracing !).

var. **rosulata** (*Urb.*) *J. Lewis* stat. nov.

W. rosulata Urb. in Not. Bot. Gart. Berl. **4,** 173 (1905). Type : Tanganyika, Ulanga District, Mbarangandu, *Busse* 680 (B, syntype : EA, iso-syntype !).

Both these taxa were described from small and inadequate specimens, especially the former. Later collections show that all the variation they exhibit is random except the leaf shape, and to some extent the height. Their reduction to varietal status is not proposed as a final solution especially as a few specimens do not separate easily on this basis ; it may become necessary to segregate other varieties or for the whole species to be considered as a single very plastic unit. This compromise solution is adopted for the purpose of the Flora of Tropical East Africa, where further information with an illustration will be available.

Deterioration in Timber.* This is a popular and practical account of the causes, treatment and prevention of deterioration in timber. Dr. Findlay's work in this field at the Forest Products Research Laboratory is well known and he writes easily and with authority. After some introductory chapters on the kinds of discoloration and deterioration encountered and especially of fungus invasion, comes detailed treatment of the destruction of wood by insects. There follow three very practical chapters on diseases of standing trees, with advice on the prevention of butt rot and top rot ; care of timber after felling and on wood preservatives. Chapter 9 deals with decay of timber in buildings with emphasis on preventive measures. Chapter 10 is of special interest to gardeners as it describes the methods of preventing decay on outdoor timbers, fences, gates, stakes and sheds, wooden greenhouses, seed boxes, wooden edging, wheelbarrows and the like. Finally come two short chapters on decay in boats, marine work, vehicles, aircraft, mine timbers, cooling towers, packing cases and plywood. The book is illustrated by numerous excellent photographs, including a beautifully coloured frontispiece of *Merulius lacrymans* and by a few lamentable line drawings of fungi.

R. W. G. Dennis.

*Dry Rot and other Timber troubles. W. P. K. Findlay, 267 pp. Hutchinson's Scientific and Technical Publications, London, 1953. 25/-.

Organisation of Plant Form and Structure.*—Morphogenesis is defined as the study of all the factors concerned in the growth, development and organisation of living matter : it is the " how " of morphology. Professor Wardlaw's book reviews the attempt to solve this problem. His was the difficult task of producing the first survey of this field, and he is to be congratulated on the breadth and balance of his work, ranging as it does over so many varied aspects of botanical science. As much of the straightforward description of plants has already been done, its scope has definite limitations. A stage has been reached when we may endeavour to explain how the final pattern comes to be, and in this book, the writer reports on the progress of various methods which have been used to attack this problem.

One approach which has claimed much attention recently, is the investigation of the form and minute structure of the shoot apex, which is the seat of formative activities, the region of continuous development and the inception of leaf and stem. Professor Wardlaw also describes his own results and those of other workers who have adopted an experimental technique, performing delicate surgical operations on the growing-point, its leaf primordia and pro-vascular tissue. The growth of normal adult plants from excised stem tips cultivated *in vitro*, substantiates that the shoot apex is a self-determining region, and offers a means of studying the controlled behaviour of the growing-point.

Reference is also made to the work of the experimental embryologist. It is cogent to study the factors influencing the polarity and segmentation of the zygote. The biochemist has approached the problem from yet another angle in his attempt to isolate and synthesise the various growth substances which are thought to control the pattern of development. But the ultimate unit of activity is the individual cell, and the author rightly draws attention to the role of the cytologist and geneticist in the solution of these problems.

This book is not the final word. It is a brief review of the results achieved and serves well as an introduction to the subject. If the outline is occasionally sketchy, this is undoubtedly due to the limitations of space, and the interested reader is referred to the author's other recent book " Phylogeny and Morphogenesis " where these ideas are more fully expounded.

Professor Wardlaw does not mention W. H. Lang's address to the British Association in 1915, in which he interpreted morphology as " the study and scientific explanation of the form, structure and development of plants ". This was perhaps the first English definition of causal morphology, though the conception was initiated by the early developmental investigations of Hofmeister and other German workers.

Solution of these baffling problems requires the assiduity of a biologist with a balanced knowledge of all the branches of his science. The co-ordinated team research of a group of specialists should produce useful results, but these need to be integrated if their significance is to be grasped. Here indeed, are inspiration and opportunity for the botanical " jack-of-all trades ", be he of nimble mind. M. Y. Stant.

*" Morphogenesis in Plants ", by C. W. Wardlaw, in the series Methuen's Monographs on Biological Subjects. pp. 176 with 4 plates and 42 text illustrations 1952. London : Methuen & Co. Ltd., New York : John Wiley & Sons Inc.

REVISION OF THE "FLORA OF WEST TROPICAL AFRICA." —IV.*

R. W. J. KEAY

CAPPARIDACEAE

Cleome montana *A. Chev. ex Keay* sp. nov., a *C. ciliata* Schum. et Thonn., habitu perenne, foliis oblongis minoribus apice rotundatis, petalis minoribus differt.

C. montana A. Chev. Fl. Viv. A.O.F. **1** : 159, t. 25 (1938), *nomen nudum* (descr. gall. tantum).

Herba perennis stirpe lignoso, caulibus numerosis erectis deinde deflectis, 20–50 cm. longis, simplicibus vel leviter ramosis. *Folia* 3-foliolata, foliolis oblongis, 6–15 mm. longis, 3–4 mm. latis, basi cuneatis, apice rotundatis et minute apiculatis, marginibus integris vel minute denticulatis ; petioli tenuissimi, 5–10 mm. longi. *Racemi* longi spiciformes terminales ; pedicelli adscendentes glanduloso-pubescentes, 6–8 mm. longi, ex axillibus foliis inchoatis sessilibus 1–3-foliolatis obovatis orti. *Sepala* linearia subulata, glandulosa, 3 mm. longa. *Petala* erecta, 6–8 mm. longa, oblonga, basi in unguiculum filiformem attenuata. *Stamina* capilliformia, antheris ovoideis. *Capsula* erecta, 3–4 cm. longa, basi stipitata, apice stylo conico 3–4 mm. longo rostrata, longitudinaliter minute striata, glabra vel paulum glandulosa. *Semina* rubicunda helicoidea, minutissime striata.

FRENCH GUINEA : Fouta Djalon, Mali, alt. 1450 m. *Chevalier* 34461 (typus in Herb. Paris).

BALSAMINACEAE

Impatiens jacquesii *Keay* nom. nov.

I. jaegeri Pellegr. et Jac.-Fel. in Bull. Soc. Bot. Fr. **96** : 168 (1950) ; non *I. jaegeri* Gilg in Engl. Bot. Jahrb. **43** : 106 (1909).

Syntypes :—French Guinea, *Jac.-Fel.* 1746 ; 1828 ; 2000 (P) ; Sierra Leone, *Jaeger* 229 ; 1182 ; 1320 ; 1332 ; 1428 ; 1451 ; 1557 ; 2019 (P).

Impatiens obanensis *Keay* nom. nov.

I. talbotii Bak. f. in Cat. Talb. Nig. Pl. 17 (1913) ; non *I. talbotii* Hook. f. in Rec. Bot. Surv. Ind. **4** : 42, 47 (1906).

Type :—Nigeria, Oban, *Talbot* 430 (BM, holotype !).

PROTEACEAE

Protea elliottii *C. H. Wright* var. **angustifolia** *Keay* var. nov. ; a typo foliis lanceolatis multo angustioribus differt.

BRITISH CAMEROONS : Bamenda Province, hill above Lake Oku, in grassland, alt. 2340 m., 7 Jan. 1951, *Keay & Lightbody* FHI. 28501 ! (typus varietatis in Herb. Kew.) : erect shrub, 1 m. high ; flowers white with crimson bracts.

*Continued from K.B. **1953,** 82 (1953).

French Cameroons : Dschang District, Bambuto Range, alt. 1900 m., *Unwin* 211 (K).

This variety seems to be characteristic of the Bamenda and Bambuto highlands and differs from *P. elliottii* of the lowlands of West Africa in the narrower leaves :—var. *angustifolia*, 2·5–5·5 cm. broad ; var. *elliottii*, 5–12 cm. broad. The other characters, especially the characteristic indumentum and the flowers, agree well with *P. elliottii* var. *elliottii*.

I am grateful to Prof. L. Hauman of Bruxelles who kindly examined the Bamenda specimen and advised about its affinities.

MYRTACEAE

Eugenia talbotii *Keay* nom. nov.

Memecylon bakerianum Hutch. et Dalz., F.W.T.A. **1** : 214, 215 (1927) ; Kew Bull. **1928** : 222 (1928) ; non *M. bakerianum* Cogn. in DC. Monogr. Phan. **7** : 1154 (1891).

[*Memecylon machairacme* (non Gilg) –Bak. f. in Cat. Talb. Nig. Pl. 128 (1913)].

Type :—Nigeria, Oban, *Talbot* 203 (BM, holotype !).

Syzygium staudtii (*Engl.*) *Mildbr.* in Wiss. Ergebn. Deutsch. Zent.-Afr. Exped. 1910–11, **2** : 188 (1922).

S. guineense (Willd.) DC. var. *staudtii* Engl. in Mildbr. Wiss. Ergebn. Deutsch. Zent. Afr. Exped. 1907-8, **2** : 582 (1913) ; Engl. et Drude Veg. Erde **9,** Pflanzenw. Afr. **3,** 2 : 738 (1921).

S. montanum Aubrév., Fl. For. C. Iv. **3** : 70, t. 268*a* (1936), *nomen nudum* (descr. gall. tantum) ; nec *S. montanum* (Wight) Thw., Enum. Pl. Zeyl. 116 (1859) ; nec Gamble Fl. Madras **1** : 479 (1919).

This species, although validly published, has only a very brief description. Judging by the duplicates at Kew of *Staudt* 491, one of the syntypes. *S. staudtii* appears to be conspecific with the excellent and ample material recently gathered by members of the Cambridge Botanical Expedition in the montane forest of Cameroon Mountain. The species is evidently common in the montane forest of the Cameroons and possibly in Fernando Po also (*vide* Mildbraed *l.c.*). It is similar to *S. rowlandii* in leaf-shape and in the angular stems and peduncles, but is much smaller in the flowers and usually in the leaves as well. As the species has hitherto been only very imperfectly known I give here a description based on *Brenan, Jones & Richards* 9357.

Arbor glabra, usque 16 m. alta, radicibus aeriis numerosissimis ad basin trunci dense contextis (ut in *Elaeide guineensi*) praedita. *Ramuli* juveniles subcompressi, quadrangulares, angulis acutis vel saepe anguste subalatis, glandulosi, siccitate brunnei vel fulvo-brunnei ; vestustiores subteretes saepe 4-costulati, cortice fulvo-brunneo desquamante ; internodia 2–5·5 cm. longa. *Folia* subcoriacea, obovato-elliptica vel elliptica, basi cuneata et in petiolum breviter decurrentia, apice acuminata, 4–10·5 cm. longa, 1·5–5 cm. lata, in vivo (fide *Brenan*) supra olivacea nitida, subtus pallide viridia, in sicco olivaceo vel fulvo-brunnea subtus semper palli-

diora, margine leviter revoluta ; costa supra profunde impressa canaliculum valde angustum efficiens, subtus valde prominens, nervis lateralibus primariis utrinsecus mediani circiter 18–30, subrectis, nervo collectivo a margine circiter 1 mm. remoto conjunctis, utrinque prominulis ; nervi laterales secundarii et venuli ultimi subtus obscuri, supra prominuli cum primariis flavi et satis obvii ; petiolus 5–8 mm. longus, supra canaliculatus. *Inflorescentiae* ramulos terminantes, obpyramidato-corymbosae, 5–9 cm. longae et latae, basi trichotomae ; axes quadrangulares, angulis acutis vel saepe anguste subalatis, axe medio 4–8 cm. longo plerumque bis vel quater iterum trichotomo, lateralibus semel vel bis trichotomis. *Flores* 3–7 apice axium ultimarum glomeratae, subsessiles. *Alabastra* circiter 5·5 mm. longa, 3 mm. lata. *Receptaculum* (calyce incluso) obconicum, circiter 5 mm. longum, apice 4 mm. diametro, extra leviter angulata, supra ovarium ad 3 mm. cupulatim productum, subtruncatum praeter lobis 4 ad apicis angulorum receptaculo brevissimis. *Petala* 4, in calyptram concavam suborbicularem circiter 3 mm. diametro mox caducam coalita. *Stamina* numerosa, filamentis 5–7 mm. longis, apice valde angustatis, antheris circiter 0·6 mm. longis praedita. *Stylus* 11–12 mm. longus, apice attenuatus. *Fructus* ignotus.

Liberia : top of Mt. Wolagwisa, near Pandami, alt. 1460 m., *J. C. Bequaert* (K ; A).

Ivory Coast : Mt. Tonkoui, *Aubréville* 1000 (P ; K). Mt. Nimba, *Aubréville* 1139 (P).

British Cameroons : Cameroon Mountain, alt. 2340 m., Feb. 1932, *Maitland* 987 (K ; FHI). Cameroon Mountain, Lyonga above Mimbia, in mist forest, alt. 1720 m., 24 Mar. 1948, *Brenan, E. W. Jones & Richards* 9357 (K) : tree about 17 m. high, with broad spreading rounded crown, branching at about 3 m., densely adventitious-rooted at base (similarly to *Elaeis*), trunk about 60 cm. diam. ; bark grey ; slash with outer bark 2 mm., grey, inner bark 15 mm., pinkish brown, sapwood cream ; young twigs green, older brown ; leaves subcoriaceous, deep green and glossy above with paler somewhat impressed midrib, pale green and somewhat glossy beneath with prominent midrib and prominulous lateral nerves ; calytra green ; filaments white, anthers pale green. Johann-Albrechtshöhe, *Staudt* 491 (K). Bamenda Province, Lakom, alt. 1875 m., May 1931, *Maitland* 1510 (K ; FHI). Bamenda Province, Bagangu, June 1929, *A. T. Johnstone* 6 (FHI). Bamenda Province, Lake Oku, alt. 1875–2190 m., *A. T. Johnstone* 5/29 (FHI) ; 1/31 (K ; FHI) ; 228/31 (FHO ; FHI).

? Fernando Po : alt. 1400–2000 m., *Mildbraed* 7132 ; 7145*a* (*vide* Mildbraed *l.c.*).

French Cameroons : Ebolowa, Yaunde, Jan. 1914, *Mildbraed* 7738 (K).

Syzygium guineense (*Willd.*) *DC.* var. **littorale** *Keay* var. nov. ; a typo foliis rigide coriaceis apice rotundatis vel breviter obtusate acuminatis, petiolis brevioribus 3–6 (–10) mm. longis differt.

S. littorale Aubrév. Fl. For. C. Iv. **3** : 70, t. 268*b* (1936), *nomen nudum* (descr. gall. tantum) ; non *S. littorale* (Blume) Amshoff in Blumea **5** : 500 (1945).

Type :—Fernando Po, *Mann* 1432 (holotypus varietatis in Herb. Kew.). On the sea coast from Ivory Coast to Gabon.

COMBRETACEAE

Combretum lineare *Keay* nom. nov.

C. arenarium Portères in Bull. Soc. Bot. Fr. **97** : 181, cum tab. (1951) ; non *C. arenarium* Engl. et Gilg in Warb., Kunene-Samb.-Exped. Baum. 318 (1903).

French Guinea : Bouffa *Portères* s.n. (typus in Herb. Portères). Fouta Djalon, Bramaya, *Paroisse* 178 (P).

Combretum nioroense *Aubrév. ex Keay* sp. nov., (§*Paucinerves*), affinis *C. micrantho* G. Don, sed inflorescentibus floribusque albido-lepidotis, ramulis petiolisque squamulis rubris carentibus, fructibus majoribus pallide brunneis differt.

C. nioroensis Aubrév. Combret. des Sav. Bois. A.O.F. 27, t. 1, 8 (1944), *nomen nudum* descr. gall. tantum ; Aubrév. Fl. For. Soud.-Guin. 113, t. 15, 8 (1950), *nomen nudum* (descr. gall. tantum).

Frutex sarmentosus habitu *C. micrantho* G. Don, sed squamulis rubris carens. *Fructus* 1·5–2 (–3·5) cm. longus.

French Sudan : de Nioro à Bamako, *Aubréville* 30-S (typus in Herb. Paris). Bamako, *Vuillet* 230 (P). Kolena, Kita, *Dubois* 78 (P). Gourma, *Chevalier* 24404 (P). Koulikoro, *Chevalier* 25936 (P).

Pteleopis habeensis *Aubrév. ex Keay* sp. nov., ab *P. suberosa* Engl. et Diels, foliis ovatis multo minoribus differt.

P. habeensis Aubrév. Fl. For. C. Iv. **3** : 61 (1936), *nomen nudum* ; Aubrév. Fl. For. Soud.-Guin. 141, t. 21, 3 (1950), *nomen nudum* (descr. gall. tantum).

Frutex sarmentosus. *Folia* juveniles velutina ; laminae adultae ovatae, apice obtusae vel obtusissime acuminatae, basi obtusae vel rotundatae, usque 3 cm. longae, 1·5 cm. latae, glabrae vel leviter pubescentes. *Flores* ignoti. *Fructus* 3-alatus, circiter 10 mm. longus et 7 mm. latus, corpore leviter pubescente ; pedicelli tenuissimi, 7–9 mm. longi.

French Sudan : Bandiagara, *Aubréville* 1776 (typus in Herb. Paris). De Bandiagara à Mopti, *Chevalier* 24914 (P). Ségou, *Vuillet* s.n. (P).

HYPERICACEAE

With E. Milne-Redhead

Psorospermum febrifugum *Spach* var. **ferrugineum** (*Hook. f.*) *Keay et Milne-Redhead* stat. nov.

P. ferrugineum Hook. f. in Hook. Niger Fl. 241 (1849).

Type : –Sierra Leone, Freetown, *G. Don* s.n. (K, holotype !).

Through the courtesy of Prof. H. Humbert of the Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris, we have been able to examine the type specimen of *P. febrifugum* Spach, which was collected in Angola by an unknown Portuguese collector early in the 19th century. This specimen was not seen by Oliver when he prepared the account of the genus for the F.T.A. Vol. 1 : 158 (1868)), and in consequence the typical form of *P. febrifugum* was then, and has been subsequently, interpreted as a plant with a dense woolly, often rusty, tomentum on the inflorescence and outside of the sepals. In fact *P. febrifugum* var. *febrifugum* is the glabrous variety which agrees well with both var. *glabrum*

Oliv. and var. *album* Oliv. As there is no varietal name, so far as we are aware, for the above mentioned tomentose plant the new combination is made, based on *P. formosum* Hook. f. which Oliver reduced to the synonomy of typical *P. fabrifugum*.

P. corymbiferum *Hutch.* var. **kerstingii** *Engl. Kray et Milne-Redhead* stat. nov.

P. kerstingii Engl. Bot. Jahrb. **53**: 384 (1919).

Syntypes:—Togoland, *Kersting* 71 (B); 597 (B). *Baumann* 568 (B; K, isotype !). *v. Doering* 220 (B).

Practical Botany*:—Doctors R. C. McLean and W. R. Ivimy Cook wrote their "Textbook of Practical Botany" with the object of providing instructions for the many types of practical work in the laboratory and field that have to be undertaken by a student reading a full course in botany at a university. The book is intended for use with the "Textbook of Theoretical Botany" by the same authors, which is to be completed in 4 volumes of which one has already appeared. It is sad to be reminded in a postscript on p. vi that Dr. Ivimy-Cook died early in 1952 whilst the book under review was still in page proof. The book is divided into 10 parts which deal respectively with "Methods", "Cytology", "Evolutionary Morphology", "Morphology and Histology of Angiosperms", "The Sexual Reproduction of Angiosperms", "The Classification of Angiosperms," "Plant Physiology," "Modifications of Normal Plant Form", "Plant Ecology" and "Variation and Heredity". In addition there are an appendix giving receipts for the stains and reagents recommended in the text, and tables of logarithms and antilogarithms, the book ending with separate indexes to "plant material" and "selected subjects" respectively. It is no small undertaking to write a book of practical instruction covering so many diverse fields, and one cannot but admire the courage and tenacity of purpose that must have inspired the authors in their work. It is, however, questionable whether the average student will wish to buy a relatively expensive book of practical instructions as well as a textbook in 4 volumes, especially when it is clearly impossible for any student, during a university course of normal duration, to undertake more than a small proportion of the many alternative types of practical work that are described. To the reviewer it appears that the instructions are so complete that they are more likely to be of value to the teacher as a reference text than to a student as a guide for his daily work. The book is, however, so packed with information that even the most experienced workers will undoubtedly find something in it of which they were previously unaware, and, by sifting the contents, students will discover useful instructions for the work they are called upon to undertake.

It is impossible, in the course of this review, to indicate in much greater detail the various subjects that are covered, but it is very unusual

*Textbook of Practical Botany by R. C. McLean and W. R. Ivimy-Cook. pp. xxxv + 476. Longmans, Green & Co. Ltd. 36/- net.

to find in a single volume directions for cytological work, for the morphological and anatomical examination of representatives of most of the important groups that make up the plant kingdom, for a wide range of physiological experiments, as well as for practical work in ecology and genetics. It is encouraging to see that the authors have not overlooked the preparation of herbarium specimens, a topic that is frequently omitted from books of this kind. Another useful feature is the series of tests that the authors describe for investigating the more important physical and chemical characteristics of soils. The book includes 127 illustrations, reproduced from photographs, which are rather variable in quality.

It is only to be expected that, in a book covering so wide a field, there will be some statements that call for comment. For example those who have to prepare sections for histological work may be surprised at the authors' wholesale condemnation of safety razor blades when used for this purpose. Although safety razor blades admittedly have their limitation, they usually have a keener edge than the average student has the time to produce on a razor of the old fashioned type, and they are therefore specially suitable for cutting freehand sections of delicate small objects. At the same time a safety razor blade can be relied on to cut a limited number of sections of hard woody material, after which it can be thrown away and a fresh one brought into use, thereby saving many hours of precious time that would otherwise have to be devoted to sharpening a razor of the old fashioned type. It is rather surprising that, although directions for staining a great diversity of material are given, there appears to be no mention or description of the staining jars in which these operations are commonly performed. It would also help many teachers and students to know that excellent sections of many diverse types of material, ranging from hard timbers to herbaceous stems and leaves, can be cut on a good sliding microtome without having to resort to embedding methods at all. This technique appears to be used much more widely on the Continent than in Great Britain. Then again, in the part of the book dealing with the morphology of angiosperms, a student might easily be misled by the statement concerning the tulip that " the true stem is the underground bulb " when, in fact, the main portion of the bulb consists of fleshy leaves. It is also wrong to describe a tulip bulb as consisting mainly of leaf bases, when all of the outer bulb scales consist of entire leaves. In this respect a tulip bulb differs from that of a Narcissus, which is, in fact, largely made up of leaf bases. Botanists who are also interested in gardening will be surprised to read (p. 193) that the Narcissus produces offsets more freely than a tulip, and the general definition of thorns (p. 195) as " branches of limited growth, ending in a sharp woody point " fails to make it clear that thorns of other morphological categories, e.g. leaves, also occur. On the whole very few errors appear to have passed the proof readers, but attention must be drawn to the rather conspicuous error in the botanical name of the Horse Chestnut on p. 431, and to the fact that Thiselton Dyer's name is incorrectly spelt in two places on p. 1.

In spite of the above criticisms, the book contains such an abundance of information on so many topics that those who wish for a comprehensive book of practical instructions will find it well worth having.

C. R. Metcalfe.

THE MEIOTIC DIVISIONS IN ANTHERS OF HYPARRHENIA EDULIS.

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Seeds of this recently and well described species (Hubbard 1952) from southern Anglo-Egyptian Sudan (Ngoni, Lande District) were received from Sir Edward Salisbury, Director of the Royal Botanic Gardens, Kew, England. The seeds were forwarded to Kew by K. R. M. Anthony in November 1951. Some of the seeds received were planted on March first, 1952, and germinated very well, about 90–100%. Five days after planting the seedlings had roots 6 inches long and the first leaves were emerging from the coleoptile. At this time the seedlings were transplanted into six-inch pots, one seedling to a pot. Twenty days after planting each plant had about 5 leaves and half of the 14 plants had the first tiller showing. On April first they were repotted in 12 inch pots and on May first were set out in the grass garden.

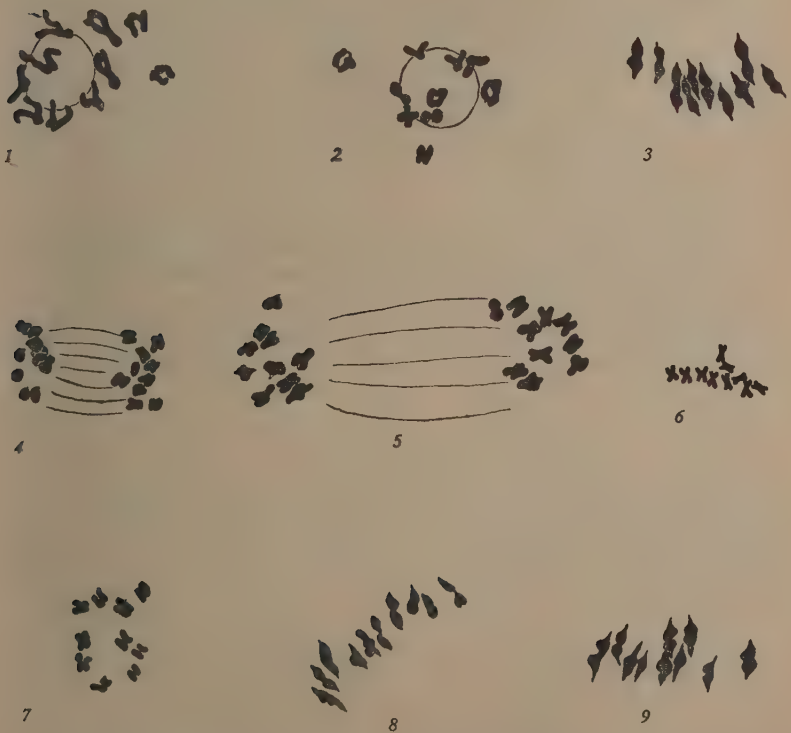

FIG. 1-9. Meiotic chromosomes of 3 plants of *Hyparrhenia edulis*.
FIG. 1 and 2. Diakinesis in microsporocytes of plant A, $n = 10$.
FIG. 3, 8 and 9. First meiotic metaphase $n = 10$, fig. 3 plant A, FIG. 8 and 9 Plant C.
FIG. 4 and 5. First anaphase of Plant A. FIG. 6 and 7. Second meiotic metaphase of Plant B.

Throughout the summer they grew in height as well as in the number of tillers until by late October the clumps consisted of hundreds of tillers (200 to 400) and varied from 5 to 8 feet in height. There was considerable variation among the plants, the species being, apparently, quite heterozygous. The plants do not do well in the dry summers of central Texas. They use a tremendous amount of water and would do better in a moister atmosphere. Nevertheless, by watering two or three times a week the plants grew fairly well to maturity.

In late October inflorescence sheaths appeared and on October 30 material for cytological study was collected from the three plants that had reached to the proper stage of development. At that time the tallest plants were about 8 feet tall.

The three plants studied cytologically by aceto-carmine anther smears have $n=10$ chromosomes. The chromosomes at diakinesis of meiosis stain poorly and are not fully contracted so that the exact chromosome number could be determined in only a few cells. Ther were not as distinct as figures 1 and 2 would indicate. In the few cells that could be analyzed there were 10 bivalents. By metaphase of the first division (fig. 3, 8 and 9) the bivalents were fully contracted and could easily be counted as 10 in many cells. Middle (fig. 4) and late (fig. 5) anaphase showed regular 10–10 segregation and these anaphase chromosomes were obviously double. Second metaphase (fig. 6 and 7) showed 10 chromosomes that segregate regularly. No irregularities of the meiotic divisions were noted. Some slight differences in chromosome size was apparent but in general all chromosomes of the species are small and of approximately equal size.

The basic chromosome number $x = 10$ (or 5 in *Sorghum*) is common to most genera of the *Andropogoneae*, the tribe in which *Hyparrhenia* is placed. The only other species of this genus that has been studied cytologically and recorded is *H. hirta* (L.) Stapf, reported to have $2n = 30$ and Garber (1944) indicates that this number points to the basic number $x = 5$. It is therefore most reasonable to regard *H. edulis* as a tetraploid species.

Literature Cited

Garber, E. 1944. A cytological study of the genus *Sorghum* : Subsections *Para-sorghum* and *Eu-sorghum*. Amer. Nat. 78 : 89–94.

Hubbard, C. E. 1952. *Hyparrhenia edulis* C. E. Hubbard. Hook. Ic. Pl. t. 3495 A et B : 1–6.

HYALOSCYPHA QUERCINA VEL. IN ENGLAND.

R. W. G. Dennis

One of the most touching figures in the history of mycology is that of the aged Velenovsky, his sight failing, sitting down among the thorns at the time of full moon to scratch for discomycetes among the litter. As a result of a lifetime's devotion to this work he published more than 1000 new species names in discomycetes alone and there can be little doubt that a considerable number of these were in fact novelties. But it is a sad comment on the futility of such devoted service that hardly any of these new species have been recognised again. Even when, by adopting similar methods, what appear to be unfamiliar microfungi are found, for example in England, it is very seldom they can be satisfactorily matched with Velenovsky's diagnoses and rather crude figures. Recently however, there have come to hand two collections of a fungus which may be identified with fair confidence with *Hyaloscypha quercina* Vel., apparently hitherto unrecognised outside Bohemia. In response to enquiries Prof. Pilat was so kind as to send on loan to Kew a fragment of the type now at Prague but no apothecia could be found on it. The identification rests, therefore, on Velenovsky's description and figure alone.

Hyaloscypha quercina *Vel.* Monographia Discomycetum Bohemiae 275 (1934).

Apothecia gregarious on wood and bark, without a subiculum. Disc 250–500μ diameter, concave, white, drying cream; receptacle soft, saucershaped on a small base sometimes slightly constricted below but never noticeably stipitate, concolorous, minutely downy and fringed with a row of long white hairs. Marginal hairs thinwalled, cylindrical, hyaline, nonseptate, rounded at the top, up to 50 × 2μ. Asci cylindric-clavate with a small pore not blued in Melzer's reagent, 8-spored, 25–45 × 5–6μ; spores biseriate, slightly clavate, pointed below, straight or slightly inequitateral, hyaline, 6–9 × 1–1·5μ; paraphyses filiform, obtuse, 1μ thick, equalling the asci. Excipular cells thinwalled, short-prismatic, 5–8μ wide.

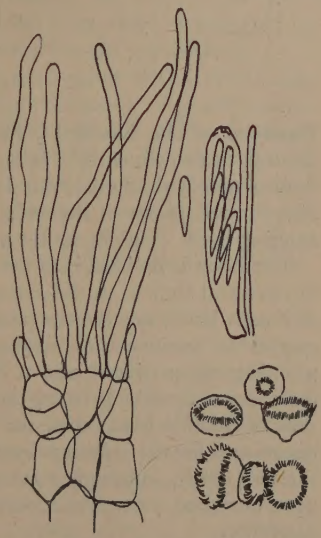

Fig. 1. *Hyaloscypha quercina* Vel., marginal hairs, ascus, spore and paraphysis × 1000, habit sketch × 20.

On the inner surface of *Quercus* bark in a pile of decaying logs, King's Langley, Hertfordshire, D. A. Reid, 21.XII.1952; same locality 4.I. 1953.

In " British Hyaloscyphaceae " I described a similar fungus, but with spores 11–12 × 2·5–3μ, under the erroneous name *Cistella tapesioides*

(Starb.) Nannf. Since then I have had an opportunity of examining authentic material of that species in the herbarium of Manchester Museum, issued in Vestergren's *Micromycetes rariores selecti* 1082, and agree with *Korf (1951) that it is a good *Arachnopeziza*. Velenovsky described briefly a var. *barbata* Vel. of *H. quercina*, with spores 10–14 μ long and I now suggest that was the fungus described as a *Cistella* in British Hyaloscyphaceae.

Window Gardening.†—This is the first British edition of a book published in America in 1949, where indoor gardening is widely practised, and where its popularity is such that two further impressions were issued.

We are told in the introduction that there are signs of a revival of interest in room plants in this country, and this edition has been published for the information of those who indulge in this fascinating hobby.

The book is well-illustrated, and deals with " Window Gardening " in all its aspects. It is provided with a good index, is arranged in a convenient manner, and forms a practical and informative guide to the subject. H. S. MARSHALL.

Flowers of the South.‡—The scope of this book is somewhat limited since it deals only with a selection of some five hundred plants out of a flora of nearly six thousand. It contains illustrations in line drawings and 55 coloured plates of the most popular flowers that grow in the country ranging from Virginia to Texas.

The book is divided into two parts and deals first with the native wild flowers and then with the exotic or cultivated plants. The descriptions, although brief, are concise and explicit, and give a general idea of the species or variety they deal with. Notes on cutting, arranging and planting are provided and a Zone Map on the end sheets of the book indicates successful growing areas. The arrangement generally follows that of Small's Manual of the Southeastern Flora (1933) for the native plants and for the cultivated exotics that of Bailey's Manual of Cultivated Plants (1949), although rigid adherence to these arrangements has not been observed, certain exceptions having been made where it was thought desirable.

The book, which ends with a good index, seems to have been carefully written and should prove a useful guide to the native and exotic flowers found in this region. H. S. MARSHALL.

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*Korf, R. P. 1951, Lloydia 14 pp. 129-180.

†A Garden in your Window. By Jean Hersey. Pp. xiv + 228. 23 illus. and line drawing in text. London : Andrew Melrose. Price 15/-.

‡Flowers of the South. Native and Exotic. By Wilhelmina F. Greene and Hugo L. Blomquist. Pp. xiv + 208. 55 col. pls. Chapel Hill, N. Carolina : University Press. London : Geoffrey Cumberlege. Price 40/-.

COMPOSITION OF CYTTARIA FRUCTIFICATIONS.

F. N. Howes.

The peculiar waxy feel and strong aroma of beeswax possessed by some specimens of the fruiting bodies of the fungus *Cytarria* received from South America (Tierra del Fuego) suggested to the writer the desirability of ascertaining whether a wax were present and if so in what quantity. This seemed desirable because of the present shortage and the high cost of vegetable waxes to polish manufacturers and other users of waxes in the United Kingdom.

The genus *Cyttaria* is parasitic on the " beeches " (*Nothofagus*) of the Southern Hemisphere and is present in both South America and New Zealand. The fructifications are sometimes produced in great abundance. Some further material was obtained from New Zealand through the kind co-operation of the Director of the Botany Division of the Department of Scientific and Industrial Research at Wellington. This consisted of fructifications of *Cyttaria gunnii* Berk. (*sensu lato*), parastitic on *Nothofagus menziesii* Oerst.—the only species on which it occurs in New Zealand. They varied much in size and colour (from pale yellow to dark or blackish brown) and had been collected in various parts of New Zealand. Some had been dried artificially, for on falling from the trees they are prone to putrify rapidly under humid conditions. Good fruiting years with the fungus in New Zealand are said to be intermittent and its presence on the " beech " trees is naturally deprecated by foresters and others on account of the galls and lesions it produces.

These New Zealand fructifications of *Cyttaria gunnii* Berk., amounting to only a few pounds, were examined in the laboratory of a well known firm of polish manufacturers with the following results :—" The material was divided into ' A ', large light nodules and ' B ' small black nodules of greater density. They were examined separately for benzine extract with the following results. 'A' (large) benzine extract (hot) about 4½% : acid value—52·6 : saponification value—276. 'B' (small)—benzine extract about 5% : acid value—61·3 : saponification value—211.

There was little difference in the nature of this extract. It was soft and sticky and dark brown in colour and appeared to consist of a mixture of resinous matter and soft fat. It had about 10% unsaponifiable matter, a soft grease, and the fatty acids were fairly hard and dark and appeared to contain some resin acids. There was no evidence of any body of a waxy nature. The fatty portion appears to contain some glycerides. Extraction of the air-dry fungus with 95% alcohol yielded 6% of a dark brown soft and sticky extract. This was separated by further extraction with 70% alcohol and yielded 40% of a soft sticky resin. The remainder was a mixture of grease and resin (mainly grease). The fungus, after extraction with alcohol, was further extracted with boiling water. This yielded 18% of a hard brittle gum-like material which forms a mucilage and has some resemblance to gum arabic, but has less adhesive properties."

It would seem therefore that in spite of the wax-like feel and the waxy aroma of *Cyttaria* fructifications no actual vegetable wax is present and they do not appear to be of any commercial value.

Plants of the Bible.*—It is a curious fact that while many botanists have been ardent students of the Bible, and many clergymen enthusiastic students of Botany, the former have generally sought solace rather than science in the Scriptures, while the latter have adopted a singularly secular attitude towards botany. This desire to escape from one world of learning to another has meant that Bible plants have hitherto received somewhat shabby treatment, for the botanists, lay and ecclesiastic, have shunned the subject, while the non-botanists have too often romanticized volubly where they were unable to speak scientifically. Botanists are naturally shocked to find such aliens as *Passiflora* and *Opuntia* flaunting themselves in Scriptural iconography, but artists and evangelists have no eye for taxonomic anachronisms, and until the present book appeared, they might well have retorted that few botanists had made any serious effort to guide their erring steps. Moreover, it must be admitted that the Ancients had greater regard for meditation than observation. There are, it is true, abundant references to plants in the Bible, but these are seldom more than details, factual or poetical, adding colour to an historical incident, a hymn of praise, or a well-turned parable ; it is rare to find a plant described with anything approaching scientific exactitude, though clearly enough, the great men of the Old and New Testaments fully appreciated the economic importance and the beauty of the vegetable kingdom.

Dr. and Mrs. Moldenke have made amends for past neglect, and with awe-inspiring energy and minute research, have compiled a volume of information, historical, etymological and botanical, which is likely to remain, for many years, the last word on a subject full of interest to students of botany and the Scriptures. Every aspect of Bible botany is touched, brief sketches of Bible history and translation, with notes on the vegetation of Palestine, introduce the reader to a detailed enumeration of scientifically named flowering plants, cryptograms and bacteria, each with detailed text references and accompanied by a concise and comprehensive commentary. Everything is carefully cross-referenced and indexed—a labour in itself enough to make us humble in admiration—and a detailed bibliography is added to complete a work which will astound and satisfy. Arrangement and printing are admirable, and the illustrations are mostly delightful, though the wood engravings from Wilson's " Picturesque Palestine " have frequently developed in reproduction a murkiness suggestive of the " darkness which may be felt ".

If any criticism can be made, one might plead *embarras de richesse*—was it necessary to include the grim agents of leprosy, tuberculosis and disease in a book otherwise fragrant with pleasant things, and should one attempt to classify such vaguenesses as " thorns " and " grasses " ? No doubt the authors have an answer, and I, for one, am content to thank them and their publishers for a very attractive and useful book.

R. D. Meikle.

*Plants of the Bible : by Harold N. Moldenke Ph. D. and Alma L. Moldenke B.A. pp. xx + 364, tt. 95 : Waltham, Mass., U.S.A., Chronica Botanica Company 1952 $7.50.